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THE ARMY IN 1962

PART II

THE OFFICIAL U. S. ARMY MAGAZINE

ARMY INFORMATION DIGEST

THE OFFICIAL MAGAZINE of the DEPARTMENT OF THE ARMY

The mission of ARMY INFORMATION DIGEST is to keep personnel of the Army aware of trends and developments of professional concern.

THE DIGEST is published under supervision of the Army Chief of Information to provide timely and authoritative information on policies, plans, operations, and technical developments of the Department of the Army to the active Army, National Guard, and Army Reserve. It also serves as a vehicle for timely expression of the views of the Secretary of the Army and the Chief of Staff and assists in the achievement of information objectives of the Army.

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WITH deep regret the DIGEST announces the death of Captain Harry E. Olmsted, Production Editor of ARMY INFORMATION DIGEST, on 5 November 1957 following a heart attack. A member of the editorial staff since July 1956, Captain Olmsted's name is carried in this month's masthead in recognition of his outstanding contribution in planning and preparing Parts I and II of this special issue.

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For explanations of abbreviations used, see AR 320-50.

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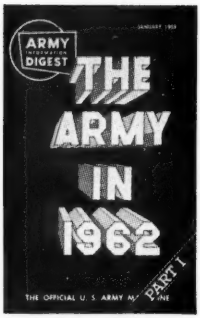


From the January 1958

ARMY INFORMATION DIGEST

THE United States Army is currently undergoing sweeping changes designed to improve its combat effectiveness on the atomic battlefield while retaining a substantial capability to fight a so-called conventional war. When these changes are completed, the resulting powerful fighting force, based on the "Pentomic" divisions, will bear little resemblance to the field armies of World War II and Korea.

IN THIS ISSUE we salute this new Army. We realize, of course, that it is difficult to describe the Army at any specific future date. Rapid technological advances and the growing dynamism of military science itself will continue to subject the "Pentomic" Army to changes possibly as revolutionary as those now taking place.

We have, therefore, somewhat arbitrarily selected 1962 as the year of the new Army. For several reasons we feel that by 1962 we should have a truly "new" Army. In the first place, our new organizations and their accompanying tactical concepts will have been completely tested and approved by that time. Further, many new and deadlier weapons, now being developed, will be in the hands of troops. New personnel management and training concepts will have been implemented, contributing to the supply of professional soldiers needed to make the new Army function efficiently. Army mobility will have been vastly improved.

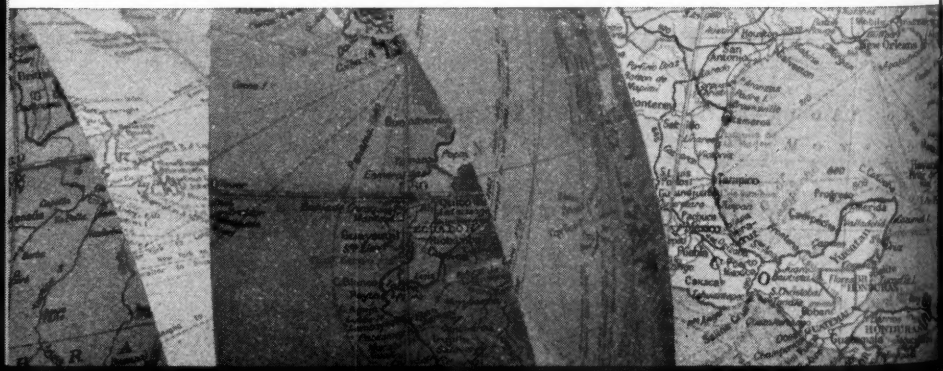
In essence, the year '62 is far enough in the future to give us reasonable assurance that most of our presently planned changes within the Army will have been accomplished.

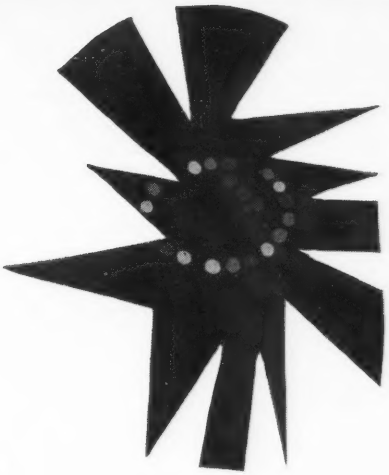
In addition, 1962 is just far enough in the future to be beyond the scope of most of our current planning. Although the Army's plans must run beyond that year in many areas, such things as budgetary requirements, manning levels, and force structure realistically require planning to be limited to the years immediately ahead. Consequently, the use of the year 1962 as the year of the new Army has permitted our authors to predict the composition, missions, and requirements of the Army without compromising or being restricted by approved plans and actions.

WHAT will the Army of 1962 be like? How will it shoot, move, and communicate? What will be the training requirements for the personnel who man the weapons and equipment? On the following pages these questions and many others concerning the new Army will be discussed by experts in the fields concerned. Our readers are welcome to formulate their own opinions as well, since the purpose of this issue is to predict, not direct, the Army of the future.

However, one thing is certain. The new Army will have unprecedented firepower, mobility, and flexibility. It will be capable of inflicting terrible casualties on enemy forces which oppose it on the ground or attack it from the air. It will truly be a vital factor in our national military posture and a worthy successor to the great American armies of the past.

The Editor





THE ARMY IN 1962—PART II

IN LAST MONTH'S ISSUE of *Army Information Digest*, the Chief of Staff, the Assistant Chief of Staff, Intelligence, and top-level experts on the Deputy Chief of Staff level projected current trends and capabilities of the Army to a hypothetical point in the near future. The anticipated nature of the tasks confronting the Army of 1962 and the areas to be emphasized in planning, training and research were outlined.

IN THIS ISSUE—"The Army in 1962—Part II"—the Chiefs of the Technical Services describe some of the innovations in doctrine, techniques and materiel that may be expected to enhance the firepower, mobility and flexibility of the "new" United States Army of 1962.

HORIZONS IN VIEW

AVAILABLE to the commander in 1962
will be advances in communications and electronics
designed particularly to improve his command control capabilities.

Important among these advances will be a radio central
mounted in an armored vehicle in the battle group area.
The radio central is essentially a radio version
of a normal switchboard that connects telephones by radio
rather than field wire.
Mounting the radio central
in an armored vehicle increases its mobility
and reduces its vulnerability to enemy fire.

The battle group commander will have available
for his logistical use
a small, mobile computer—part of the automatic data processing system—
to calibrate concentrations,
determine fallout patterns of enemy as well as friendly weapons,
and calculate march tables
and other useful information.

Command Control Capabilities

Major General J. D. O'Connell

NEW TACTICS and techniques required for the Army of the future have brought about entirely new thinking in the plans and development of tactical equipment.

As a basic premise, it is recognized that there are three determinants of success for the tactical commander. He must have adequate firepower, maximum mobility and command control. Of these, command control is a vital complement of firepower and mobility.

On the battlefield of 1962, tactical commanders will have increased command control of their firepower and mobility through new communications, combat surveillance and electronic warfare systems. Advanced communication means will give continuous and reliable control over mechanized and airborne battle elements.

New surveillance systems will provide for target acquisition at increased depths within enemy areas. Commanders will be able to disrupt the control, firepower and intelligence capabilities of the enemy through an expanded system of electronic warfare.

A new Area Communication System for the 1962 Army will increase

the commander's communications potential. The system permits him to control more subordinate units over longer distances. At the same time, it is less likely to be physically disrupted by atomic weapons and is less vulnerable to enemy jamming. Through expanded use of dial switching and mobile radio facilities, it will have the flexibility required by pentomic concepts for the control of high-speed, mobile forces.

The system will provide communications to a larger number of users, even though they are frequently at greater distances than ever before. New communication equipments, many of them transistorized, will give increased ranges and greater channel capacities without corresponding increases in operating personnel.

A proposed Automatic Data Processing System extending throughout the Army will permit a rapid flow of selective operations, intelligence, personnel and logistic data. This can be transmitted and received by all Army units through the medium of the new Area Communication System. Better information control and a more rapid transmission of instructions will be

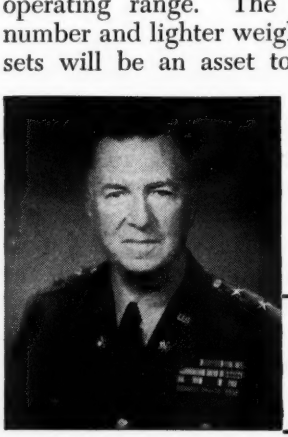
attained. Reaction time will decrease while responsiveness to fire, maneuver, support will increase.

These mutually supporting systems will link all echelons from the battle group to field army.

THE battle group's system includes new transistorized radio sets, short-range surveillance radars and radio centrals. There would also be small data processing input devices.

Increased command control will be extended down to the squad leader. Using either a lightweight helmet radio or a pocket type radio, the squad leader will be able to control and coordinate more easily and effectively the actions of individual riflemen. Closer combat teamwork will be possible within the squad. These lightweight radios will operate on more than one frequency.

A new family of tactical radio sets will give our forces operational compatibility from the squad leader to the division commander. Forward area troops will have a flexible communication system with more available channels, fewer types of equipment, and greater operating range. The decreased number and lighter weight of these sets will be an asset to mobility.



Through these improved coordination means, Infantry, Artillery and Armor commanders and their subordinate elements will have better mutual support.

Since there will be fewer types of equipment in forward areas, the problems of operator training and organizational maintenance will be reduced. Maintenance will be further simplified by use of standard and plug-in components and readily available test points to check these sets quickly. The requirement for skilled technicians would also be minimized by using automatic test equipment.

Uninterrupted command control at battle group level, permitting greater flexibility and maneuverability, will be provided through radio centrals. *(See Figure 1.)* The radio central—essentially a radio version of a normal switchboard—connects telephone sets by radio rather than field wire. By dialing a number in his command vehicle the battle group commander will be able to reach elements of his command and the division areas through a radio central mounted in an armored vehicle in the battle group area. Mounting the radio central in an armored vehicle reduces its vulnerability to enemy fire and increases its mobility in cross-country operations.

The battle group commander will be able to use a small, mobile computer and associated parts of the automatic data processing sys-

MAJOR GENERAL J. D. O'CONNELL is Chief Signal Officer, Department of the Army.

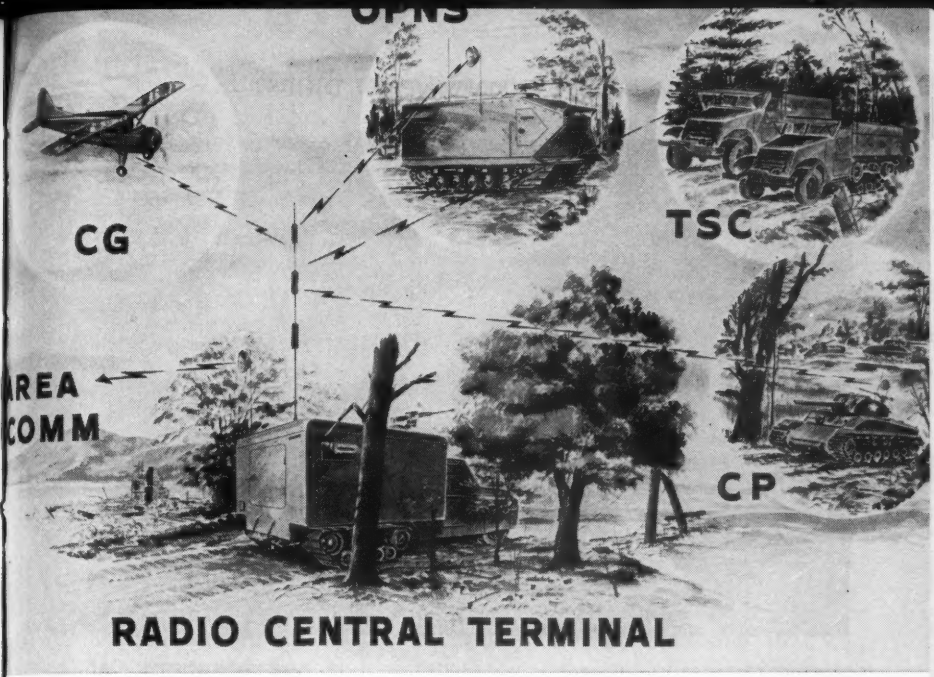


FIGURE 1.

"The radio central connects telephone sets by radio rather than field wire, permitting greater flexibility and maneuverability."

tem to calculate enemy concentrations, determine fallout patterns of friendly and enemy weapons, collate intelligence, calculate march tables, and perform other tasks.

The company commander will have a supply of pocket size punchcards. Information placed on these cards and fed into the data system will be transmitted to battle group headquarters where it would be stored in electronic form in a memory component. Information or inquiries will be processed at battle group headquarters where commanders would use this data in reaching decisions.

NUCLEAR warfare demands that terrain be controlled by a minimum of personnel. With units more widely dispersed, terrain not physically occupied must be controlled by firepower. To effect such control, the area should be under continuous surveillance.

To accomplish this mission the battle group uses short-range combat radar sets (*See Figure* 2), and a medium-range battlefield radar set. Augmenting the present system of outposts and listening posts, these radars provide surveillance of an area thousands of yards to the front and the flanks, day and night, and under all weather conditions. By covering avenues of approach to the battle group position, they give advance warning of enemy infiltration and movements in gaps between friendly elements.

The division system will include a new Area Communication System using radio relay centrals and automatic switching equipment. As the heart of the system, two mobile radio relay centrals will connect the division headquarters by direct

FIGURE 2.

"The battle group uses short-range combat radar sets and a medium-range battlefield radar set for surveillance day and night, in all weather."

telephone to the battle groups and supporting elements.

During tactical maneuvers, a division commander may personally observe and control elements of his command from an airborne command communication center, even while this headquarters is displacing.

Equipments will be dispersed for maximum flexibility throughout the area. They will not be complicated or tricky to operate, and their mobility will be compatible with the tactical echelons at which they are used. Basically, they will be an advanced design of present sets, reduced in size and weight and improved in performance. In short, they will be small, lightweight, and simple to operate.

THE new Signal Corps vehicular air-ground radio set will make possible improved control and coordination of tactical aircraft. A lightweight man-packed set will also be used by forward air control teams in front-line areas. Forward area command control will be extended by using airborne radio relay stations. By relaying communications between ground units, these stations can extend the range of multi-channel radio systems in the event a tactical unit is separated or isolated in enemy territory.

To supplement surveillance at the battle group level, the division commander will have his own long-range ground and airborne radar and drones which are also integrated in the entire combat surveillance system.

In addition to radar, timely and accurate intelligence information will be obtained through the use of drones. *(See Figure 3.)* These will carry a variety of sensing means while making deep penetrations into enemy territory and returning. They could be flown over an area

to get detailed information of enemy movements and concentrations which may have been previously detected by ground surveillance such as the radars. The resulting information would be quickly delivered to the commander through high-speed developing and processing techniques.

AUTOMATIC data processing equipments at division level will consist of data recording and storage devices and small-capacity mobile computers. In contrast to the large and bulky commercial equipments used by industry, these will be small and light.

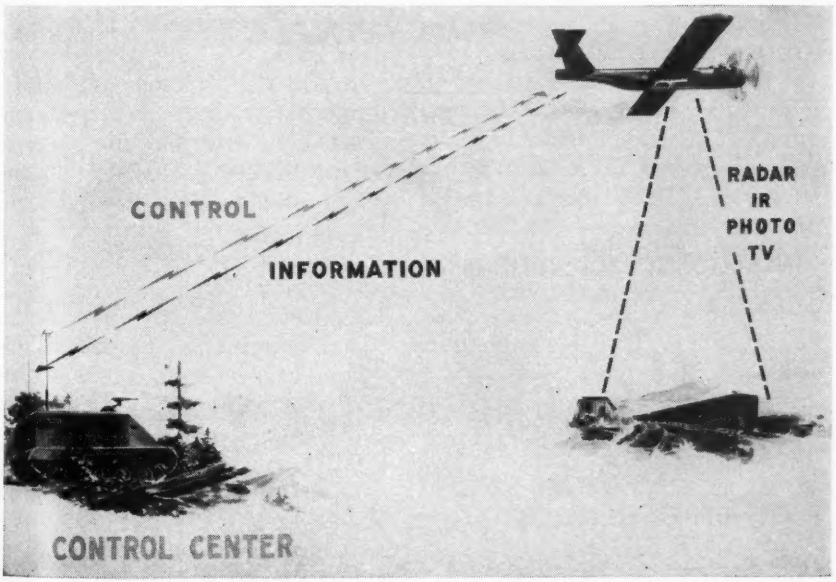
Data introduced into the division system will be transmitted to the mobile computers through the Area Communication System. This data will help the various commanders review the situation; it will help them analyze the probable results of various courses of action (both friendly and hostile) and thus will expedite decisions.

The equipment will also be used to compile essential reports—daily personnel summaries, requisitions by units, troop lists, personnel estimates, strength reports, projections on a scheduled basis—the mass and unwieldy flow of which have always been a problem to combat echelons.

Similarly, the intelligence staff will be able to obtain current information more quickly. When essential data is not available at lower echelons, the processing unit can interrogate and obtain information from corps or army, or from an adjacent division. Requests for supplies from subordinate units also can be consolidated and sent to appropriate supply points for ac-

FIGURE 3.

"In addition to radar, information will be obtained through drones . . . making deep penetrations into enemy territory and returning."



tion, thus largely eliminating the manual time-consuming aspects of this task.

At corps and army levels, new techniques and equipments in the army area communication system will furnish operational cohesion to the field army. *(See Figure 4.)* The system's improved capability will be due largely to increased channel capacity.

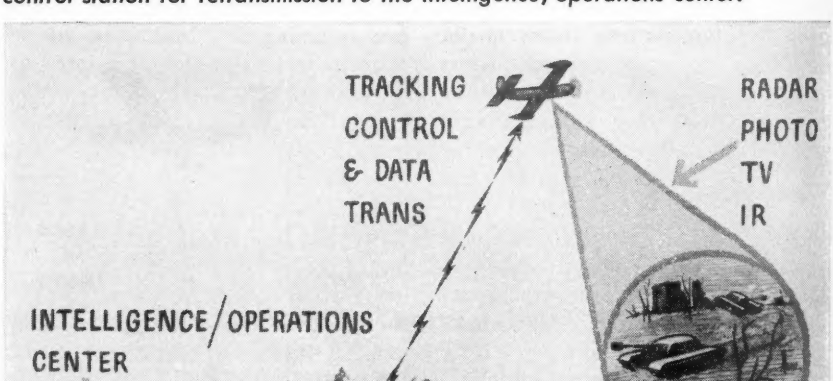
An increase in such front-to-rear communication links will make possible improved flexibility of operations. Traffic can be re-routed easily through the system, and direct circuits can be provided to meet sudden increases in demand. This feature is particularly vital when parts of the system may be damaged by enemy weapons.

The system also will provide better operational direction and the refined coordination essential to missile control. Direct communication to subordinate units in isolated areas will be maintained by multichannel radio.

THE Army commander of 1962 will have much faster command control over dispersed tactical support elements. A Tactical Operations or Support Center will give him refined means of coordinating artillery, electronic warfare, tactical aircraft, antiaircraft and combat surveillance elements. This center *(See Figure 5)* will use a variety of communication means to display information on the status and disposition of support elements available to the Army commander. Improved information control will enable him to direct their actions with utmost rapidity.

FIGURE 4.

Drone aircraft mounting surveillance equipment will transmit data to the ground control station for retransmission to the intelligence/operations center.



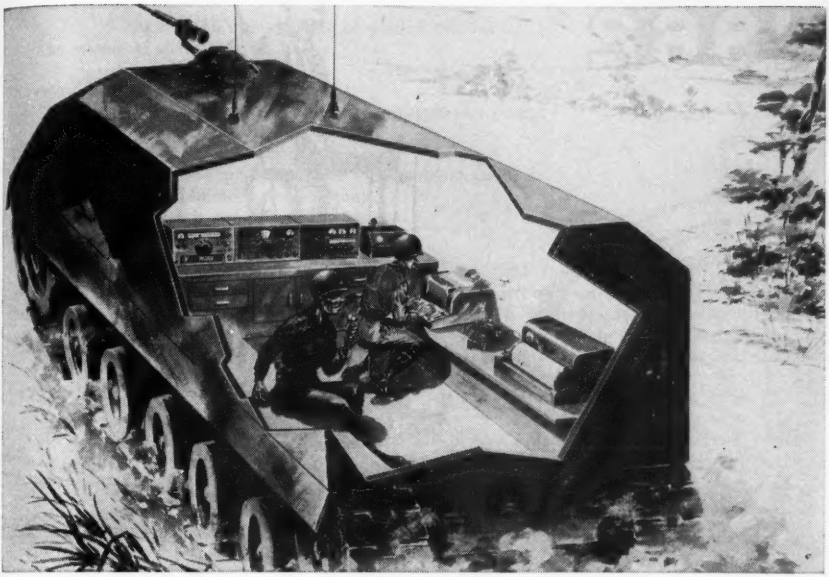


FIGURE 5.

"The Tactical Operations or Support Center will use a variety of communication means to display information on . . . available support elements."

Mounted in vehicles, the Center can move quickly, and go into immediate operation. Among its facilities will be a computer where target information, priorities and selection of targets may be calculated rapidly.

Improved employment of Army aircraft will be achieved through advanced air navigation and traffic control systems. This will enable aircraft to fly missions more effectively in daylight or darkness and in all kinds of weather.

Army and corps commanders will also obtain information for intelligence purposes through radar, and photographic devices mounted in drones or aircraft. These will operate on a longer range basis than those used in divisions. Damage assessment and target acquisition data can readily be made available to higher echelons.

As in the division and battle group, corps and army commanders will have data processing equipment at their disposal. These render essentially the same service, but their capacities will be greater.

In making the transition to the Army of the future, of greatest importance is the problem of giving it all the many new and higher speed capabilities without loading echelons down with a mass of complicated and cumbersome equipments. Solution to this problem lies only in a systems approach which seeks essential advances at minimum costs.

Final integration of all these systems will provide commanders with facilities to enable them to achieve complete command control—the vital complement to the greatly increased firepower and mobility of the 1962 Army.

Transportation for

Major General Paul F. Yount

THE ARMY of the future must have a transportation system which will support highly mobile, dispersed forces.

Atomic warfare, by its very nature, dictates mobility and dispersion. Under such conditions rapid delivery of supplies to the combat forces is a prime essential. The problem, however, is accentuated by the fact that large stockpiles of supplies can no longer be accumulated within range of enemy aircraft or guided missiles.

It follows that all modes of transportation must be integrated into a system which will accomplish this objective of getting supplies all the way to the ultimate consumer "enough and on time." This is the job of the Transportation Corps.

Currently, the Army is moving in the direction of increased use of air transport in moving supplies, but the objective of 100 percent air line of communication is not immediately in sight.

Accordingly our plans must include both air transportation and express surface transportation. Such an integrated system involves full use of such features as sched-

ORDINARILY one thinks of guided missiles
as means of delivering warheads
on distant targets.
However, within the foreseeable future,
they will be playing the role of messengers of mercy,
delivering emergency supplies.
Development of this mode of supply
has passed far beyond the theoretical stage and,
while problems remain to be overcome,
success is not far away.

BASICALLY, the problem involves
converting the present warhead of the missile
to a carrying case for supplies.
Warheads would be pre-packaged in single-type loads,
such as ammunition, medical supplies, food, fuel
or other items urgently needed
at some location within missile range
of the launching site.
The missile would be guided to the general region
and then zeroed in to the exact spot
for a unit supply drop.

THE mission of the Transportation Corps
in the Army of 1962
remains as before—
to deliver troops and supplies any time, anywhere
by the most efficient mode available
to insure that the transportation requirements
of the Army of the future are met fully and on time—
by traditional methods, new methods
or any methods that may be imagined and devised.

or Tomorrow's Army

uled supply, automatic data processing, and unitization of cargo—all designed to assure that supplies move on schedule to meet the requirements of combat units.

ANOTHER implication of this fast-moving, dispersed supply system is the urgent need for centralized control, for optimum utilization of air transportation, both land and water based, express surface transportation and rapid handling of cargo. This basic concept of control is termed, very simply, Transportation Movements.

Actually, Army transportation movements are but one facet of a larger pattern. In any future war the logistics system of the entire economy must be responsive to the executive just as military logistics must be responsive to the military commander. It may be expected, therefore, that there will be a War Transportation Administration which will allocate the United States' commercial transportation capability between the military and the civilian economy. This allocation will be in terms of total requirements—not just those of a

single shipment of items to a theater.

Commercial transportation allocated by the War Transport Administration will be divided among the military departments by the Joint Military Transportation Committee (JMTC), an agency operating for the Joint Chiefs of Staff.

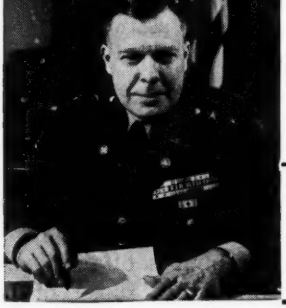
In addition, the JMTC will divide the capability of the Military Air Transport Service (MATS) and the Military Sea Transportation Service (MSTS) among the Armed Services. The Chief of Transportation will then program the utilization of the Army portion to meet its logistical requirements. This programming will include a distribution of traffic to continental United States (CONUS) terminals, and also the necessary coordination with MATS and MSTS.

The procurement of commercial transportation within CONUS and the release of export traffic will be handled by the Military Traffic Management Agency (MTMA). This agency—an activity under the Chief of Transportation, manned by personnel from the Army, Navy, Air Force and Marine Corps—was formed when the Secretary of the Army was made single manager for traffic management in CONUS. The various Army zones, Air Force districts, and Navy and Marine Corps freight control offices were subsequently consolidated, and five regions were designated to handle traffic management within the Armed Services.

IN THE Army of 1962, improved procedures will expedite the rapid movement of supplies to the consumer. Scheduled oversea resupply will be used to the maximum extent and will move primarily by ocean vessels. Existing airlift capability will be available for critical cargo and/or troops, and as more air transport becomes available, it will be possible to deliver shipments closer to the consumer and thus reduce intermediate transportation problems.

Shipments will be documented, of course, but unitization of supplies will simplify this procedure. Initial shipping documents will be valid from the source to the consumer regardless of the number of times a shipment is transferred from one unit or mode of transport to another. Where copies are required at intermediate points, these will be made by instantaneous reproduction methods.

Unitization — the technique of packaging supplies into units for shipment—will be used as far as possible and practical, from manufacturer to consumer. Supplies will be unitized at the depot, or even by the manufacturer, by strapping



MAJOR GENERAL PAUL F. YOUNT is Chief of Transportation, Department of the Army.

packages on pallets or by using easily handled containers (cargo transporters) for direct delivery from the factory or depot to the user. Such unitization will expedite cargo handling by reducing the quantity of containers which must be handled. (See "Transport Without Wheels," November 1956 DIGEST).

In addition, the roll-on, roll-off method of cargo handling will greatly expedite loading and discharging. Vessels even now being designed for this concept will permit fast handling of tanks, trucks, and other self-propelled vehicles which account for a substantial portion of military cargo.

These vessels, with a cargo tonnage capacity 25 percent greater than a Liberty ship, can be loaded or discharged in a relatively short time. Unitized supplies, loaded on vehicles, would be placed on roll-on, roll-off vessels. In this way, greater utilization of cargo space will be obtained, and the movement of supplies on and off vessels will be accelerated.

AIR transportation and air terminal operations are of growing importance in future Army operations. Air Force transport airplanes as they increase in size and load carrying capacity are becoming increasingly capable of moving the various types of battle supplies from the zone of interior to overseas bases. Other shorter range Air Force troop transport airplanes are capable of moving supplies from rear bases in theaters of operations into the Army combat zone as well as being capable of transporting Army airborne forces on air-landed or air-dropped assault combat operations.

Within the combat zone the Army is rapidly increasing its organic capability for air transport of troops, equipment, and supplies. The Army is developing a family of STOL (Short Take-off and Landing), VTOL (Vertical Take-off and Landing), and helicopter aircraft capable of performing a myriad of transportation tasks varying from moving combat troops across obstacles to the more routine movement of supplies from the Army maintenance areas forward to the combat units.

Some of the items of inventive genius, now under development, which may be expected to enable the Army of the future to meet the challenge include: Hiller Flying Platform; Delackner Aerocycle; Sky Hook, a radio-controlled flying pallet; Flying Crane, a heavy lift helicopter designed to lift 8 to 16 tons for short distances at low speeds; an aerial vehicle capable of performing all tasks commonly associated with the land jeep; the Bell XV-3 utilizing the tilting rotor principle; the XV-1 Convertiplane; and a nuclear-powered, remote-controlled cargo-carrying device with VTOL capabilities. (See "Army Aviation Looks To The Future," July 1957 DIGEST.)

TERMINAL operations in conflicts of the future will be conducted from existing port facilities and undeveloped beaches. Major new construction will be avoided. Instead, roll-on, roll-off type vessels, conveyor-type discharging apparatus, amphibious equipment, and spud barges will be employed.

Methods of discharging roll-on, roll-off ships will be standardized

Some of the items of inventive genius now under development which may be expected to enable the Army of the future to meet the challenge include . . .

as much as possible, and ocean transports and cargo vessels will be modified to accommodate helicopters for priority discharging operations. Units will be reorganized as necessary to permit decentralized operations and administration.

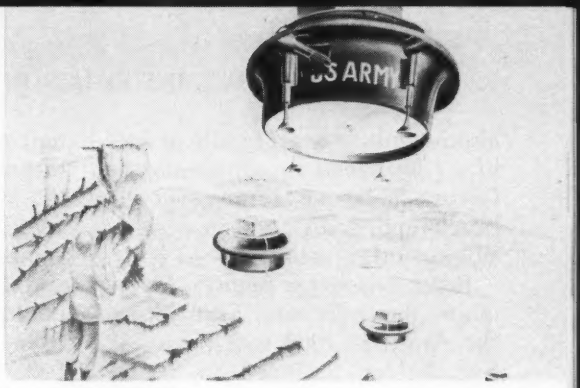
Equipment being used on inland waterways today seems adequate for the foreseeable future. Composed of various sized self-propelled and nonpropelled barges having adaptations for dry, liquid, and refrigerated cargo, with modern tugs, the inland waterways fleet is a model of efficiency.

NEW items for use in terminals, now in varying stages of development, need only minor refinement to make them serviceable in the Army of 1962. Others require more work to make them ready for production. All of these equipment items have a job to do in the future Army.

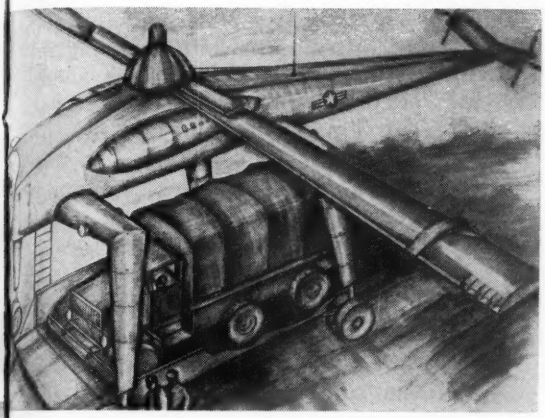
The Barc, for example, was designed to transport Army vehicles

The DeLackner Aerocycle powered by outboard motor.

The Hiller Flying Platform with ducted fan for lift.



The Sky Hook, a radio-controlled flying pallet.



A Flying Crane that will carry up to 16 tons.

and heavy cargo up to 60 tons from ship to shore, over beach and to points inland. It has a rated speed of 7 miles per hour in water and 14 miles per hour on land. On land it can negotiate grades up to 60 percent and it can turn within a radius of 75 feet. Already tested in Northeast Air Command operations and in Transportation Corps support of the DEWLINE, it is proving a most effective development.

The Landing Craft Retriever—designed to recover broached, beached, damaged, and otherwise inoperable craft along the beach—can recover landing craft having lengths of 70 feet, beams of 22 feet, and weights of 70 tons, as well as other materiel within these weight and size limits, in water up to six feet deep.

The Spud Barge, developed under Transportation Corps supervision, serves as a sea island for an aerial tramway or as a ready-made pier for a packaged port. Rapidly telescoping caissons permit establishing a port in any part of the world in a matter of hours. Connections about 300 feet long have been designed to allow the speedy flow of cargo from pier to shore.

The Overland Conveyor System, even now undergoing engineering tests, is designed to carry unitized cargo and to provide an alternate means of moving cargo inland from a beach or port. It will minimize short hauls and alleviate beach and port congestion by providing more continuous cargo transfer than is possible with motor trucks and forklifts. The Transportation Corps

also intends to use a family of forklifts (developed by Quartermaster Corps) to move cargo over the beach and across terrain inaccessible to other vehicles.

Beach Discharge Lighter. Among other developments available to the Army of 1962 will be a 338-foot lighter designed to receive vehicular and other cargo directly from MSTS roll-on, roll-off vessels and move it to the beach. Loaded truck-trailer units will be able to move under their own power onto the beach lighter via a ramp bridging two vessels at the stern. Its cruising range will permit transoceanic voyages for self-delivery to a theater of operations.

MOTOR transport for the Transportation Corps of the future demands development of faster, more efficient vehicles to handle heavy loads over poor terrain in adverse weather. Trucks with increased capabilities for off-road operations are needed, as well as a sufficient quantity of vehicles or truck-trailer combinations which can be air transported and which have large capacity and low ground pressure.

Among items in prospect for the motor transport service of 1962 are the Logistical Off-Road Train and the Rolling Fluid Transporter.

The Logistical Off-Road Train is one answer to the Army's need for a combination of maximum mobility consistent with high cargo-carrying capacity in remote, undeveloped locations such as polar or desert regions where supply routes are long, fuel supplies scarce and roads non-existent. Designed to carry a payload of 150 to 200 tons at speeds up to 25 miles per hour, it will consist of a lead vehicle and ten powered cargo trailers, with the main generating power car as the rearmost element. The lead vehicle houses the six-man crew, a complete communications system and a small power plant for propelling the car when it is detached from the train. Each wheel (10 feet in diameter and 4 feet wide) is powered by a separate motor receiving its power from the generators in the rear car. Overall length with the ten trailers is 450 feet. Studies indicate that the application of nuclear power to this equipment is both technically and economically feasible.

The Rolling Fluid Transporter is a unique item developed to transport gasoline and other liquids in large low-pressure bags which also serve as a substitute for wheels. The containers are harnessed together so that a number of them may be towed behind a prime mover. It can operate both on and off the road.

ON THE assumption that some railway equipment and trackage will be seized intact in forward areas, the Transportation Corps plans maximum use of this facility. Admittedly vulnerable because of its inflexibility, rail transport nevertheless presents high tonnage capability which must be fully exploited at every opportunity.

The principal operational problem in this sphere is the variety of track gages and clearance restrictions existing in foreign countries. Accordingly, the Transportation Corps has adapted all of its rolling equipment for world-wide operation over any gage track and our freight fleet has been so designed that box cars, gondolas, or special-

ized cars can be evolved from the basic underframe.

Perhaps no single field within transportation is as vital to future operations as maintenance. Since the Army can no longer afford huge tonnages of standby and replacement major items, new designs in equipment will incorporate self-lubrication systems to permit continuous operations; subassemblies and engines will be designed for rapid exchange and installation by user units; component parts will be standardized; refueling operations will be simplified; administrative functions of requisitioning and job order procedures will be streamlined to reduce delays due to paperwork.

The entire problem of maintenance is under study to preclude the deadlining of a vehicle for minor repairs. Methods of rapid exchange of engines and components are being studied to reduce the current reserve of vehicles now required in a theater for exchange purposes.

In view of the expected volume of air traffic, the Corps plans to have an aircraft retriever and a lightweight repair facility capable of being air-transported to forward areas for aircraft maintenance.

NECESSITY for more rapid handling of supplies with a minimum of manpower requires improvement of containers, pallets and packaging methods. Containerized and palletized cargo reduces handling, checking, damage, and pilferage, and permits ease of transfer between various modes of transportation. However, packaging must be lighter and more durable to permit air drop and better protection against severe weather. One-way airdrop and airhead operations favor the development of containers which need not be returned but which will have a secondary utility at the point of drop.

Ordinarily one thinks of the Army's missiles as means of delivering warheads on a distant target. However, within the foreseeable future, they could be playing the role of messengers of mercy, delivering emergency supplies. Development of this mode of transport has passed beyond the theoretical stage.

Basically, the problem involves converting the present warhead of the missile to a carrying case for supplies. Warheads would be prepackaged in single-type loads—*i.e.*, ammunition, medical supplies, food, fuel, or special supplies—and some could be multiple-type, inserted at the point of launching. Such a supply missile could be guided to the general region and then zeroed in to the exact spot for a unit-supply drop.

REGARDLESS of the development of atomic warfare tactics and logistical problems, the mission of the Transportation Corps in the Army of 1962 will remain as before—to deliver persons and things anytime, anywhere by the most efficient mode available.

Great challenges loom in the future, but as fast as they assume specific form, new concepts will be launched and practical solutions sought to ensure that the transportation requirements for the Army of the future are met, fully and on time.

1962

Conserving Fighting Strength

Major General S. B. Hays

IT is not likely
that the Army Medical Service will be granted
any notable increase in resources
even though it faces a far greater casualty load,
both military and civilian, in the event of atomic war.
But this does not mean that the Service
expects to be overwhelmed by the task.
There is much that can be done,
and every one in the Army can participate.
In the event of nuclear war,
with a great imbalance between corpsmen and wounded,
it is important that every soldier know
the few things that can be done to save his own life
or that of his combat buddy—
and know these few things well.

WHY does the Army have a combat medical service?

There are two reasons, each of them strong enough to stand alone. The first is philosophical or humanitarian. Civilized man has come to look upon the preservation of health as a basic right. The dignity and worth of the individual human being is a concept inherent in the American way of life; it is an aspect of the culture which the United States Army fights to defend. The citizenry from which our soldiers are drawn demands for its members ready access to good medical care regardless of station or rank, economic status or pay grade.

The second reason is downright practical, almost mercenary. The medical salvage of manpower is a paying proposition. In six or eight weeks a man with an uncomplicated abdominal wound can be back at full military duty. If there was a certainty that the next war would be finished—and won—in three or four weeks at the most, then the man with the abdominal wound would simply be salvaged for return to the national manpower pool. But if that future war lasts for several months or longer, then his case is of immediate personal interest to the Army commander.

For this individual represents the salvage of an item of the scarcest military commodity, the one which is truly indispensable to the prosecution of war. It takes 19 years to produce a soldier. No other weapon of war has a comparable lead time. In dire circumstances, comforts can be curtailed

IN A mass casualty situation,
doctors who are general practitioners or internists
will have to do emergency surgery.
Nurses will have to perform duties
ordinarily performed by doctors.
Skilled enlisted men will have to perform
duties ordinarily performed by nurses,
and the less skilled will have to take over
some tasks from the skilled.
Unskilled tasks will have to be performed
by the lightly wounded or by volunteers
who can be picked up from the local population.
This requires training.
Such a program is already under way
for physicians, nurses, dentists, veterinarians,
Army Medical Specialist Corps officers and corpsmen.

and humanitarianism can be deferred. But it is the same dire circumstances which place the greatest demands on manpower. Under such circumstances, a few more men may spell the difference between *Win* and *Lose*.

MEDICAL service pays. It pays in terms of military capability. And it pays far more than its own way. A study based on 70,000 Korean combat casualties who reached medical treatment facilities offers some revealing statistics. About 2 percent died, about 9 percent were eventually separated from the service for disability and 89 percent returned to duty. Important to the field commander are the figures showing *when* these men were returned—5 percent within 5 days, 10 percent within 10 days, 20 percent within 20 days, 31 percent within 30 days, and 54 percent within 60 days. Speaking geographically, 49 percent were returned to duty within the Far East Command. These men were trained and experienced, and hence invaluable as replacements. Many were returned to their old outfits with consequent heightening of morale.

Good combat medical service is particularly important in maintaining troop morale and the will to fight. While the soldier going into combat realizes full well that he runs the risk of being killed or wounded, he is immeasurably bolstered if he knows he will get the best possible medical care.

BROADLY stated, the mission of the Army Medical Service is to conserve fighting strength. Basically this is accomplished through three instrumentalities:

- Selection and elimination of personnel,
- Preventive medicine — *i.e.*, the maintenance of health, and
- Curative medicine, or the care of the sick and wounded.

PERSONNEL SELECTION

BECAUSE the people who comprise the Army make the Army, the importance of selection and elimination is self-evident. Constantly the importance of physical fitness is stressed throughout the Army—but fit for what? Fit to be a combat infantryman in Alaska in the winter? Or fit to be a typist at a stateside post in the spring?

The Army has always tried to get the best physical specimens it could, but as Army personnel requirements in relation to the Nation's available manpower pool have fluctuated widely, so has the physical fitness of those who came in the Army. World War II saw a

MAJOR GENERAL S. B. HAYS is The Surgeon General, Department of the Army.

progressive reduction in physical standards as the pool shrank in size. When the manpower pool is large and requirements few, the Army will try to skim off the cream. Conversely, when requirements are large in relation to the pool, the Army will have to take what it can get.

The really big problem, however, is the utilization of this manpower. The problem boils down to the question—How can we best utilize the type of men we will have in wartime?

IF WE are to utilize manpower effectively, we must place each man in a job for which he is best suited. This involves two things: the study of the attributes of the individual—physical, mental and psychological, as well as his experience; and a study of each job in the Army to determine what attributes are needed for the job. Only then can we begin to match resources and requirements.

So far we have only begun to scratch the surface of this problem. Yet it is this area which offers promise of great improvement in the overall efficiency of the Army.

MAINTENANCE OF HEALTH

MOST persons think of preventive medicine as the prevention of communicable disease, and associate it primarily with injections of vaccines. Actually in the Army it is one of the most important functions of command. It includes accident prevention, diet, sanitation, living conditions, body armor, digging foxholes, taking evasive action, cover with firepower, the importance of aggressive action as opposed to passive defense, the psychological conditioning of troops for combat, and many others.

Any reader of history is aware of the staggering losses from disease sustained by American armies in the Civil War, the Spanish-American War, and even in World War I. Even today, the causes of these losses have not been exterminated. They still exist, but measures for the maintenance of a healthy Army hold them in check. Once our guard is relaxed, they can return with great force.

Yellow fever, for example, has recurred in Panama after an apparent absence of decades, and it is slowly progressing northward in Mexico. Experience in the Middle East has demonstrated that immunization alone will not bar an epidemic of typhoid, if standards of sanitation are relaxed.

The maintenance of health has for a long time been looked upon as the prevention of *disease,* but now the prevention of *injury* is coming to the fore. Body armor proved eminently successful in Korea, but its development, even for conventional warfare, is not yet complete. Extension of the protective clothing concept gives promise of major reductions in losses from the thermal and blast effects of nuclear explosion.

CURATIVE MEDICINE

BOTH in peace and war, the bulk of Army Medical Service effort is concerned with the care of the sick and wounded.

The quality of medical practice in the Army has improved immeasurably in the last fifteen years. In the Korean War only about 2 percent of the casualties who reached

medical treatment facilities died. This remarkable performance was due in no small part to antibiotics and to modern surgical and medical management.

But let us consider those who never reached medical treatment facilities. Additional lives might have been saved if hemorrhage could have been promptly controlled, or means for aerial evacuation kept open. It is this period immediately after injury that offers the greatest opportunity for improvement in our mortality rates.

Although public interest was aroused by surgical care and mortality rates, the handling of neuropsychiatric combat casualties in Korea was even more important from the standpoint of conserving fighting strength. Applying principles learned during World War II, we brought a psychiatrist into the division and gave all medical officers some orientation in psychiatric principles. Emphasis was placed on the importance of return to duty at the earliest possible moment and as far forward as possible.

During World War II, of all patients evacuated beyond the division 22 percent were neuropsychiatric cases; in Korea 16 percent. In World War II, of all neuropsychiatric casualties, 10 percent were evacuated to continental United States; in Korea 3 percent, with 97 percent returned to duty in the theater.

THE FUTURE

PLANS for the Army Medical Service of the future—like plans for all elements of the Army—must anticipate conventional war, nonconventional war, assistance to civilian communities which may be attacked, or combinations of these.

Over the years, the Army Medical Service has been able to render satisfactory medical support of combat outfits in conventional war by employing in medical units approximately 6 percent of the total strength. This has been true because in conventional warfare, casualties are generated rather gradually (at least in comparison to nuclear warfare), in relatively small numbers, usually along the line of contact with the enemy.

Under this arrangement, medical service is echeloned from aid man to battalion aid station to division clearing company to forward hospitals and hospitals in the rear. Patients are evacuated to the rear for treatment and are returned to duty as far forward as practicable.

Nuclear warfare differs from conventional warfare in that casualties will be generated rapidly, in many cases almost instantly and in much larger numbers. With warheads delivered by aircraft and guided missiles, casualties would occur not only at the line of contact but at almost any place.

A pressing problem facing the Army Medical Service is that of balancing medical resources and the casualty load. Viewed realistically, it may be expected that the Army Medical Service will not be granted any notable increase in resources even though it faces a far greater casualty load in atomic war; even so, this does not mean that it expects to be overwhelmed by the task.

Military medical services are not totally lacking in such experience. At the battle of the Nive, in the Peninsular War, some 5000 men

fell in one hour in an area about 1500 yards in diameter. At Antietam, some 14,000 men fell in one day, and they were cared for reasonably well in the light of medical knowledge of that day.

WHAT can be done, then, to increase available medical resources? Actually, there is a great deal we can do, and everyone in the service can participate. In the event of nuclear war, with a great imbalance between corpsmen and wounded, it is important that every soldier know the few things which he can do to save his own life or that of his combat buddy—and know those few things well.

Previously basic trainees had five hours of First Aid instruction, much of which was "nice-to-know" rather than "need to know." Recently this was increased to eight hours. From the Army Medical Service standpoint, at least 20 hours are needed.

As another step to augment our resources, medical personnel can be trained to handle more difficult tasks. Doctors who are general practitioners or internists will have to do emergency surgery. Nurses will have to perform duties ordinarily performed by doctors. Skilled enlisted technicians will have to perform duties ordinarily performed by nurses, and less skilled technicians will have to take over some tasks of skilled technicians. Relatively unskilled tasks will have to be performed by the lightly wounded or by volunteers who can be picked up from the indigenous population. This requires training. Already such a program is underway for doctors, nurses, dentists, veterinarians, Medical Service Corps officers and corpsmen.

Many steps can be taken to reduce the workload in a mass casualty situation. The principle must be adopted and emphasized of "the greatest good for the greatest number." While this sounds simple and logical, actually it is complex and radical.

Members of the medical profession are basically humanitarians, and humanitarians generally follow the principle, "The greater the need, the greater the urgency," or put another way, "The worst comes first." The principle may seem academic today, but project yourself as a doctor into a mass casualty situation of the future—.

You have five improvised operating rooms staffed and busy. In the hall which serves as a preoperative ward there are already 200 wounded awaiting surgery and more are constantly arriving. Here is a man with a rather extensive flesh wound of his thigh. Here is one with a badly mangled hand. Another has a sucking wound of the chest and is coughing blood. This one has a small wound which has penetrated the abdomen. That one a large abdominal wound with viscera extruding. Over here are three head injuries, one conscious and restless, the other two in a coma. And so on for two hundred.

It is for you to decide the order in which they go to the operating rooms. Their lives are in your hands. Several have died in the hall within the last 15 minutes. Some of them will live without any surgery, although perhaps at a later date some reparative work may be necessary. Some will require surgery but it can be postponed for

hours or perhaps days. Some will die unless surgery is done promptly.

It is in this latter group that some of your most difficult decisions will lie, because you *know* that some can be handled within 15 to 30 minutes, whereas others—an abdominal wound, for example—*may* take only 30 minutes, but on the other hand the surgery *may* take two or even three hours.

Finally there are those so badly injured that they will probably die in spite of any surgery that can be done, but even in this group are some who are long shots and perhaps can be saved. On the principle of "the greatest good for the greatest number," if you and all those working with you do a superb job perhaps you can save 80 percent; but on the principle of "the worst comes first" you will save a much smaller number.

IN ORDER to reduce its workload more nearly to manageable proportions, the Army Medical Service has been preaching the gospel of triage—*i.e.*, sorting—as an essential function at every stage of evacuation and treatment. Under this policy, the principle of the greatest good for the greatest number is emphasized. In a mass casualty situation, for example, cases would be sorted into four groups:

(1) Those who will survive without treatment or with rapid minimal treatment on the spot. Many of these would be returned to duty promptly, and could fight effectively.

(2) Those who must have surgery promptly in order to survive.

(3) Those who require surgery but who can be delayed until more urgent cases are cared for.

(4) Those whose chances even under ideal conditions are so poor that others warrant priority. These would receive nursing care, relief from pain and would be cared for to the utmost extent of capabilities.

Whether this system will reduce the workload sufficiently to balance our resources in a mass casualty situation will depend entirely on the extent of those resources and the magnitude of the workload.

ONE OF the most perplexing problems of nuclear warfare facing the Army Medical Service and the Army as a whole is the question of civilian casualties. Unless warfare is waged on the open sea or over an uninhabited land mass, civilian casualties will undoubtedly occur, and they may well be more numerous and important than our military casualties.

How long, for example, will friendly peoples remain friendly if we do not help them in distress? And what about our own people? When the bombs are down and thousands or, more likely, millions of our people—our own families—are suffering, is the Army going to say, "Sorry, but we have a war to fight. You will have to do the best you can without our help"? I think not. I am inclined to think that the Army Medical Service will pitch in with everything it has to help in the emergency.

IN readying a realistic medical

service for possible nuclear war, the Army Medical Service plans to maintain the highest type of medicine and surgery. Its standards will remain high. It will stretch its resources to the limit to bring the greatest good to the greatest number, thus effectively conserving fighting strength.

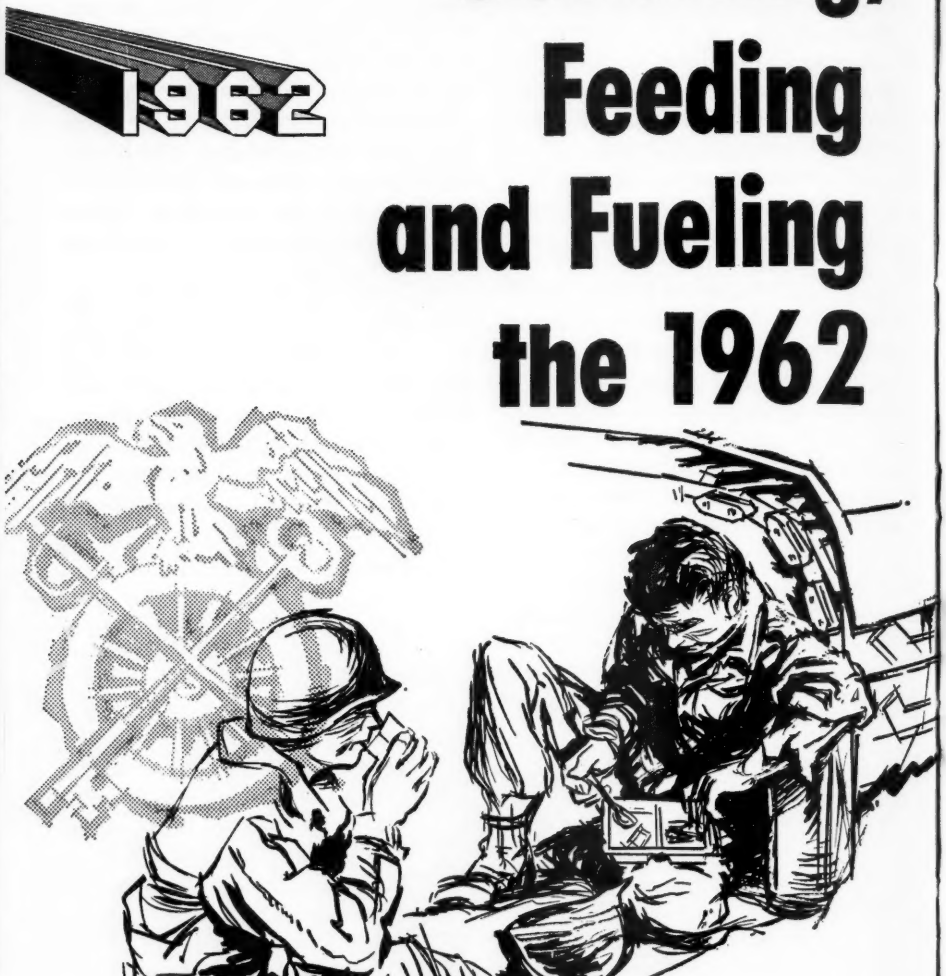
In conclusion, an analogy from another technical service is perhaps pertinent:

The Army Quartermaster is proud, and justly proud, of his C ration. It is nutritionally adequate; it is palatable; it can be delivered at the time and place when it is needed, in spite of the exigencies of war. The A ration is regarded as better; it provides more variety, and it can be made far more attractive. But the quality of the A ration does not detract from the quality of the C. Both are needed.

Heretofore, we have not envisaged packaging medical service in two forms, but now we may have to do it. For nuclear war we must have a "C ration" type medical service—one which will sustain body and soul, and one which can be delivered when and where it is needed, but one which is minus many of the "niceties" to which we are accustomed.

This we can do and will do. The individual soldier, his family and his commander may be assured that the Army Medical Service will continue to care for all casualties, collectively and individually. All patients will receive appropriate treatment on a realistic priority basis.

Outfitting, Feeding and Fueling the 1962 Soldier



Major General A. T. McNamara

COMBAT soldiers in the war of the future,
even those in isclated units,
may be found eating oranges and slices of chicken
with French-fried potato sticks.
There will be no need for skilled cooks in forward areas.
There will be no more tin cans to be opened
and disposed of,
nor need for special refrigeration
in forward areas.

ALL THIS will result from much diligent work
in pre-packaging,
more efficient and lighter weight containers,
irradiation of foods plus greatly improved dehydration processes,
and the inclusion of disposable mess gear
in pre-packaged meals.

THE MOST unusual innovation is irradiated foods,
with the Quartermaster General coordinating research
for all services in this field.
By the end of 1960 a pilot plant
at Sharpe General Depot, Stockton, California,
is expected to be processing irradiated food
in sufficient quantities for large-scale testing.

TASTE of foods will be improved
by better dehydration techniques.
Much of the food now is pre-cooked,
and needs only hot water to make it edible and attractive.
Troops will be served bread that appears to be fresh,
and that tastes fresh,
but which has been preserved by pasteurization.

CHANGES in tactical dispositions of ground troops now being evolved under the Army's pentomic organization are reflected in Quartermaster Corps plans for fulfilling its dual task of supply and service to insure that its activities will be properly geared and meshed to the new concepts.

While all the technical services face very much the same problems, those of the Quartermaster are compounded and intensified because of the fundamental and continuing responsibilities of supplying food, clothing, petroleum products and general supply items. In addition, the Corps also must provide a number of essential services—laundry, clothing repair, refrigeration facilities, and the recovery, identification and interment of deceased personnel.

To perform all of these functions for a divisional unit of the type in existence during World War II and Korea demanded certain expenditures of time, manpower and transportation facilities that were generally understood.

But reorganize that division under the new pentomic concept, and then disperse the five battle groups over hundreds of square miles of territory—some even perhaps behind enemy lines; break up the battlefield to the point where there are no actually well defined lines anyway; further scatter smaller units of the battle groups

over still more territory; have these troops so highly mobile that they will strike at one place today and be many miles away on the same day; compound all of this by the vastly increased demands that will ensue for delivery of food and petroleum products—and it is apparent that the tasks of the Quartermaster Corps will be highly complicated.

Preparing now for the Army as it will apparently exist in 1962, the Corps is carefully working out facts and figures from field exercises and maneuvers of today and tomorrow. Planners now feel that the problems of fulfilling Quartermaster functions for 1962 may be stated in a mathematical formula something like this:

$$S = (UD)^2$$

That is, Supply difficulties will be intensified as the square of Units times the Distance that separates them. In other words, dividing a Division into five striking units will not mean simply five times as much time and effort for the Quartermaster Corps, but compounded many times because of the distances that will separate units, and the mobility that is being built into the striking forces.

As has been the case through recent years, such problems cannot be solved merely by adding more men and equipment. They must be solved largely with the same numbers and within the limitations of not too greatly increased costs. This obviously means new techniques, better planning, better management practices, more efficient use of men and equipment.

Despite the difficulties involved, it may safely be said that as a result of planning and research the Quartermaster Corps will insure that the widely dispersed, highly mobile units on a future battlefield will receive their needed petroleum and other supplies, and will be better fed and better clothed than ever before.

The Quartermaster Corps, it should be remembered, is responsible also for supplying, feeding and clothing the various service troops as well as the rifleman—something not ordinarily considered. With units of the other services and support groups also widely scattered, again Quartermaster functions will not be made more simple or easy.

Since supply is such an important part of the Quartermaster function, newer and more efficient methods of packaging and of moving vast amounts of goods are the constant subject of our research and development. In the fields of clothing and food the Quartermaster also is responsible for quality.

MAJOR GENERAL A. T. McNAMARA is The Quartermaster General, Department of the Army.

Consequently research is being conducted to provide higher items of clothing, improved rations and more efficient food packaging.

In all of these activities the Quartermaster Corps works in close cooperation with the other service and support organizations—utilizing better means of communications, lighter trucks and other transportation devices, new tank trailers, flexible pipelines, the latest findings of medical and electronic research, and so on.

IN planning for delivery of food and other equipment and supplies to the Army as it will exist in 1962, air support plays a major role. Without this essential aid, it would be next to impossible to keep troops supplied with the materiel that would enable them to operate as now envisioned.

Air support takes three forms—airborne operations in which personnel and equipment are dropped from aircraft; air-landed delivery in which the plane lands and unloads its cargo; and aerial delivery which entails dropping supplies from planes in flight.

Aerial delivery is the latest development in this area. Actually the Army has used it for some time but generally it was restricted to emergency measures. Now, perforce, it will be more generally used, either as a normal means of delivery for some types of units or as an alternate to air-landed means when it is necessary to bypass the preparation and use of fields or landing strips.

Aerial delivery in fact will give the tactical commander a freedom of action never before enjoyed. He will be able to take his unit wherever the battle situations demand, confident that he can be fully and quickly supplied. Aerial delivery is not roadbound, nor limited by the necessity for air strips. Air-landed delivery is likewise flexible, not tied to roads, railroads or to mine-free sea lanes. However, it is dependent on airstrips of some sort, which often are difficult to prepare or which may be under fire to prevent landings.

At present there still are some disadvantages to aerial delivery, chief of which is that it is rough on cargo—a factor, incidentally, which is not true of air-landed methods. However it is not necessarily more damaging than shipments in trucks over rough roads. Already, research and development has devised better methods for protecting supplies while in transit than was made in the previous entire century for ordinary shipments.

THREE methods of aerial delivery now are in such a state of advancement that they can be applied for practical use—free-fall; the paradrop or low velocity drop; and stabilized fall or high velocity drop which comes between the extremes of free-fall and use of large parachutes.

Obviously free-fall can be used only for certain items—non-breakable cargo such as baled clothing, fortification materials, maps, photographs, letters. For other than non-breakable items, the packaging task would be too bulky and costly.

Procedures for paradrop are now very well established. Use of parachutes has the advantage of making the fall easy on cargo. But there are disadvantages — initial cost and maintenance of equip-

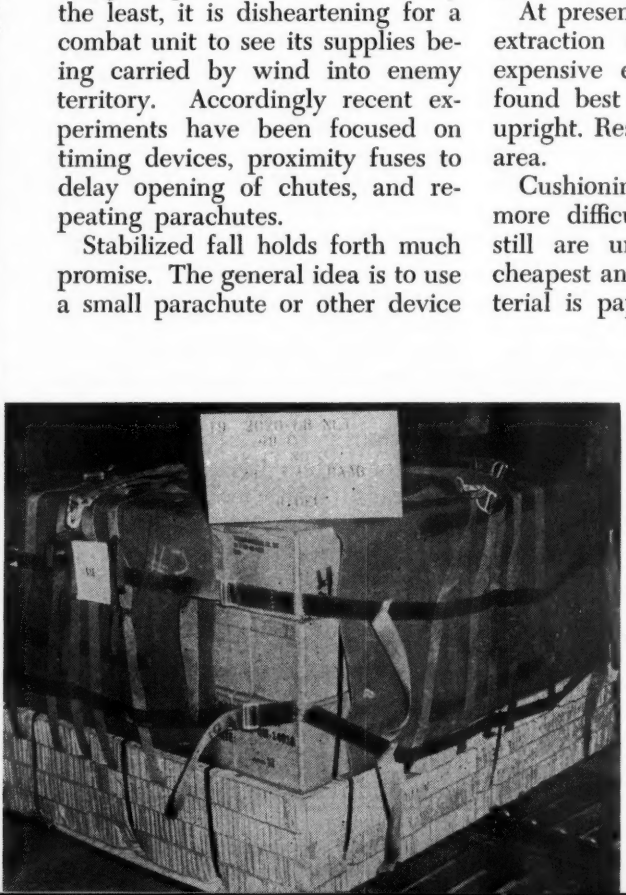
A 525-gallon collapsible container for petroleum products is suitable for air-drop to front lines.

ment, bulk of chutes in the plane, difficulty of recovering equipment, need for expert riggers, packers and repairmen. Finally, there is the great problem of drift. To say the least, it is disheartening for a combat unit to see its supplies being carried by wind into enemy territory. Accordingly recent experiments have been focused on timing devices, proximity fuses to delay opening of chutes, and repeating parachutes.

Stabilized fall holds forth much promise. The general idea is to use a small parachute or other device to hold the load upright so that it will land on its base, where cushioning material protects the supplies at the moment of impact. This is called "attitude control."

At present a 24-foot ribbon-type extraction chute — relatively inexpensive equipment — has been found best for keeping the loads upright. Research continues in this area.

Cushioning material presents a more difficult problem, and tests still are underway. So far the cheapest and most satisfactory material is paper honeycomb, which



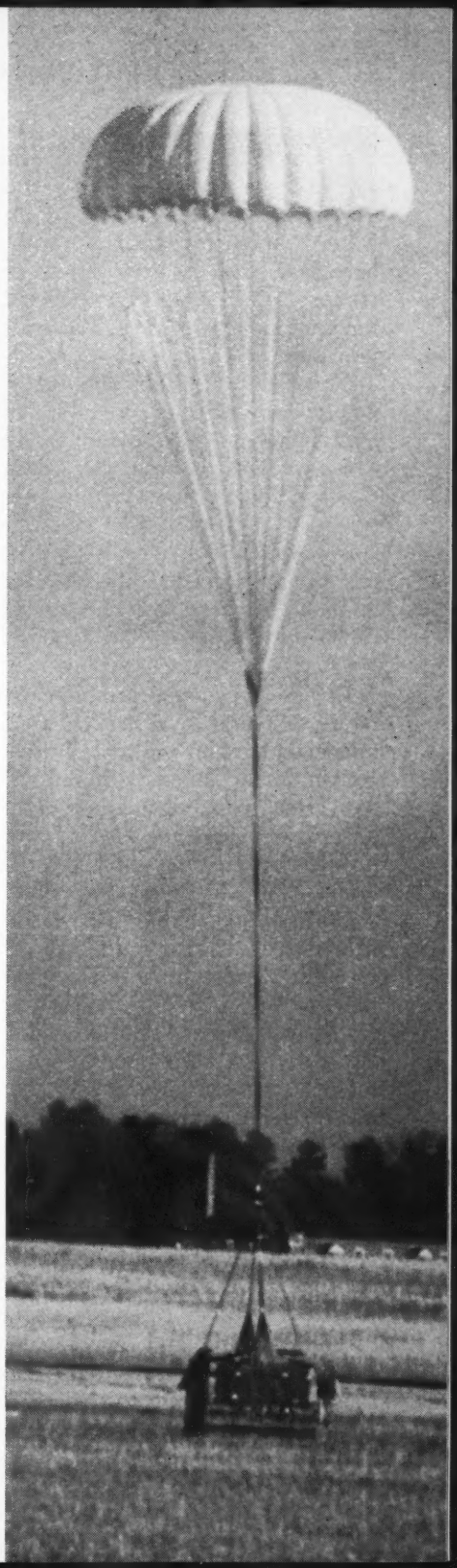
READY for aerial delivery, a ton of C rations is packaged with 12 inches of paperboard honeycomb . . .

is available commercially in various cell sizes and thicknesses. To be most effective, it must land squarely; shock absorption is less when the landing is made at an angle. The material is also less efficient when wet, and the cells sometimes explode before complete crushing. To resolve some of these problems, the Forest Products Laboratories of the Department of Agriculture is engaged in special studies under contract.

ALTHOUGH still being perfected, the system of aerial delivery is already well advanced; only technical details and improvements are needed. On a future battlefield where pentomic divisions would be employed, its application might take this form:

A palletized unit load for a particular combat or battle group is assembled. Contents include supplies issued by the various technical services in accordance with the supply schedule of the unit involved. Contents may be modified by temporary changes transmitted by the communications network as recorded on punch cards or electronic tape.

These loads are placed aboard the aircraft which speeds off to the combat zone. There it uses stabilized fall to drop the palletized load, and other similar unit loads, to the battle groups to which they are consigned. They descend swiftly, at precisely the point designated in advance or marked out



LANDING in a high-velocity airdrop guided by a 24-foot parachute, the undamaged package is quickly retrieved.

by the ground troops at the very last minute. They are so packed as to be safe in landing, but are easily uncrated. Food, ammunition, water, medicines and any other necessary equipment will reach the troops even though they may be far from any other means of transportation.

Not only does air support by whatever means cut down on delivery time, but it also reduces the necessity of maintaining depot stocks all along the supply pipelines. This is a vitally important consideration, for it will conserve on shipping, needed storage facilities and the like, and therefore cut down on manpower and expense.

EVEN petroleum products will be air deliverable, at least to a certain extent. This will entail use of conventional planes equipped with converter kits, or cargo planes loaded with bulk containers. Work now is progressing on bulk containers that can be air dropped.

Considering that petroleum products have represented as much as 50 to 75 percent of military supply tonnage in World War II and Korea it is evident that as vehicles are equipped with more powerful motors, as more aircraft and more self-propelled equipment come into use, this aspect of supply will become increasingly important.

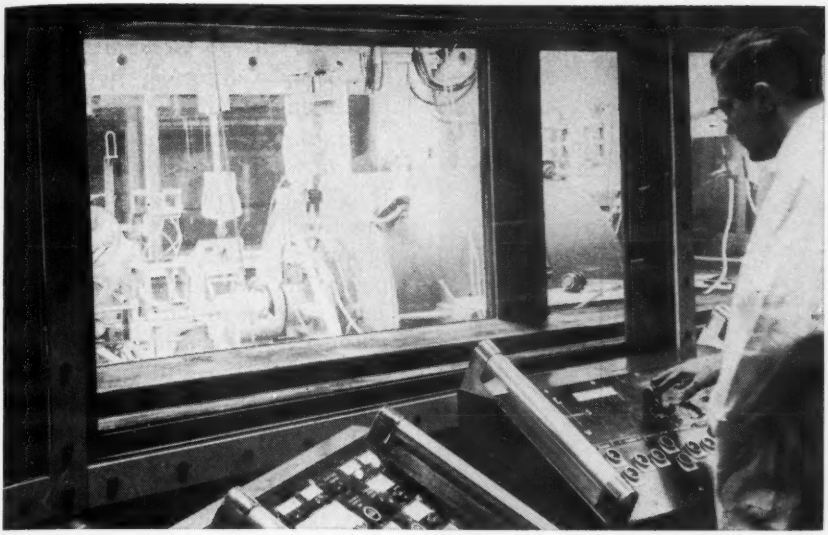
Quartermaster planning therefore has been particularly concerned with the entire area of petroleum distribution. Current practices involve extensive use of 55-gallon drums and 5-gallon cans in combat areas. Considering that these add materially to tonnage to be transported, this means considerable waste of manpower; moreover, there are added losses in filling and emptying the cans, in evaporation and contamination, and in the eventual loss of the containers themselves.

THE solution now being evolved is bulk distribution all the way to the vehicles that consume the products. Significant developments already have been obtained in three fields—new type containers, improved methods of distribution, and improved transfer equipment.

Most essential will be an improved organizational concept and more accurate controls. Under the concept a single operating agency will be established which will be responsible from shipside until the product is turned over to using units. Hourly reports, handled by automatic data processing, will provide close control. Thus depot facilities can be minimized. Enough petroleum products must reach units to supply their needs, but too much would overtax limited storage facilities.

Under this system, a tanker can anchor offshore almost anywhere—ports may be too vulnerable to air attack to be used extensively—while the product is pumped either through a flexible floating pipeline or an underwater line, to a family of tank farms ashore or even submerged in still water. These tank farms may be made up of flexible containers that can be put up or dismantled in a matter of hours.

Pipelines will extend as far forward as possible. From the end of the line, petroleum products will be distributed in bulk form by tank truck. In addition to the pipeline, distribution also will be made by truck, rail or barge where condi-



Intense gamma radiation preserves food by irradiation. Here laboratory tests seek improved methods.

tions permit. Aircraft can and will be used, both for bulk distribution and for air-dropping to units.

BULK containers used in aerial delivery or tank trailers or vehicles equipped with converter kits will serve as filling stations in the field. There will be a whole family of bulk containers. One type now available is a pillow-case container that holds 10,000 gallons. It can be rolled up when empty for storage and transportation. Containers of 25,000 and 50,000 gallon capacity are being developed which can be submerged in still water, or used on land.

Still another development is a cylindrical collapsible container which can be transported in boxcar, truck or plane, or slung under a helicopter, or even towed for short distances like a roller.

Also being developed by the Corps of Engineers for use in this area is a flexible, portable pipeline which can be laid at the rate of 40 miles an hour. It even can be laid from helicopters. At the same time, the Ordnance Corps is enlarging the family of tank trailers—which like the converter units can also be used as filling stations. Tracked petroleum products carriers that can be used in any terrain also are being developed.

The Quartermaster Corps, meanwhile, is testing a collapsible container that has been delivered successfully by paradrop. Some experiments also have been made with 5-gallon flexible free-fall containers for dropping to small isolated units.

Still other improvements include automatic nozzles that can be used during blackout, and high-speed portable transfer pumps.

IF THE fields of aerial supply and of new methods of delivering

Freeze-dehydration provides the soldier in combat with meat items that compare to fresh products.

petroleum products reflect revolutionary innovations, the field of subsistence will witness startling changes. Combat soldiers, even in isolated units, may be found eating oranges and slices of chicken with french-fried potato sticks; there will be no need for cooks and KP's in forward areas; no more tin cans to be opened and disposed of; no need for special refrigeration.

All this is the result of much work in pre-packaging, more efficient and lighter containers, irradiation and pasteurizing of foods plus greatly improved dehydration processes, and inclusion of disposable cooking containers and mess gear in pre-packaged meals.

Most unusual innovation is irradiated foods, with the Quartermaster Food and Container Institute in Chicago performing research for all three services in this area. By the end of 1960, a pilot plant at Sharpe General Depot at Stockton, California, will begin processing irradiated food for test.

Irradiation prevents contamination in food by killing microorganisms or disrupting their internal functions so they can no longer reproduce. The food is packaged before it is irradiated to prevent any contamination that might ensue from handling and packing. Exhaustive studies now being conducted by the Army Surgeon General indicate the food to be wholesome and nutritious.

New dehydration techniques that have been developed have resulted in improved flavor and palatability. Much of the food now can be precooked and needs only addition of hot water to make it completely edible. Thus the need for skilled cooks in combat areas is minimized.

Irradiation also promises better foods. Troops now will be served with bread which appears to be fresh but actually has been pasteurized by irradiation. This promises greater possibilities in variety for fighting units unable to reach a mess presided over by a cook. Irradiated or dehydrated meals will be packaged in varying units according to the areas for which they are intended. (See "Feeding Tomorrow's Army," May 1957 DIGEST.) These will include individual meals ready to eat cold, up to a 25-man uncooked meal for rear areas which will require cooking but no refrigeration. In forward areas pre-cooked dehydrated meals needing only hot water for preparation will replace the old C-ration.

Prepackaging and new types of packaging will result in great sav-

ing in costs, weight, and space.

Just when these rations will be fully available for troop use depends on the development of production facilities. It may be eight or ten years before all of the new meals are part of the standard Army issue but they will be introduced as production permits. Under the spur of an actual emergency, production doubtless would be speeded up.

AS has been stated, the Quartermaster is responsible for quality and development, as well as delivery, of clothing items. A continuous program is being conducted to simplify the clothing logistics system and to provide more durable and, above all, more protective and lighter items of clothing. Research will continue in Arctic clothing based on the "layer" principle and other types as well; and also in the area of providing for special hot-dry, hot-wet, and wet-cold uniforms for soldiers who may serve in deserts, jungles, or temperate climates anywhere in the world. As new items are proven, they will of course be adopted and issued.

In the area of protection, however, the Army five years from now will quite evidently require items of special protective clothing, and it is the Quartermaster function to provide them. The armored vest, made of layers of laminated nylon, will continue to be improved, made lighter and stronger. Butyl rubber-coated cotton fabric clothing for handlers of guided missiles and missile fuels are now being tested. They will resist penetration of corrosive acid or fuel for up to eight hours, as compared to about a quarter-hour for present fabrics.

IN THESE major areas, so vital to logistics operations in the Army of the future, the Quartermaster Corps is solving the huge problem of petroleum products supply; evolving methods to supply combat units by aerial delivery; and developing improved feeding and clothing systems.

Taken together, they assure the fighting man of 1962 the essential ingredients that will enable him to sustain himself under dispersed conditions, while moving with speed and certainty to the fulfillment of his combat mission.

In combat situation, riflemen can prepare 5-man quick-serve ration by simply adding hot water.

1962

Major General E. C. Itschner

The Engineers' Futur

THE SEARCH for maximum combat effectiveness on the battlefield of tomorrow is a vital and continuing process. Final solutions as to ways and means have by no means reached fruition. There are, however, certain clear guidelines or developmental objectives which characterize all of the Army's forward-looking theories dealing with the conduct of land combat in the atomic age.

They represent no revolutionary departure from the still valid principles of ground warfare. They provide, instead, a reorientation of emphasis designed on one hand to

exploit the effective use of atomic weapons in land combat and on the other to reduce drastically the vulnerability of ground forces to the effects of atomic weapons employed by the enemy.

Reduced to basic essentials, these objectives for improving future land combat capabilities may be stated as follows:

- To develop the full firepower potential of advanced weapons through the effective employment of flexible, reliable and responsive *weapons delivery systems.*
- To exploit the effects of advanced weapons, to allow for greater dispersion, and to bring adequate force to bear swiftly at decisive points through greatly increased *tactical and strategic mobility.*
- To provide security against the effects of enemy atomic weapons through increased emphasis on dispersion, physical protection and other *passive defense measures.*
- To provide effective support to the increased tempo of combat operations through a modern, flexible but *minimum logistics system.*

In its role as both a combat arm and a service, the Corps of En-

...r Role

THE Army's world-wide construction program is developing capabilities and know-how among indigenous populations in many countries of the world, and is providing a wealth of experience to our military and civilian engineers. This overseas base construction program greatly increases our capabilities for strategic mobility.

THE Corps of Engineers program for development of heat and electrical power from prototype nuclear reactors offers a good solution to the problem of supplying fuel at remote locations. Nuclear power plants will provide dependable, self-contained power sources which are less vulnerable to enemy action against extended supply lines.

gineers is actively pursuing programs for improving its own effectiveness and that of the Army as a whole in each of these areas.

WEAPONS DELIVERY SYSTEMS

KEEPING pace with rapidly advancing Army progress in the field of rockets and guided missiles has posed problems which cover the full range of Engineer functions and activities.

Of major concern has been the problem of developing important items of supporting equipment for these systems. Provision of mobile equipment for the generation, storage and transport of liquid oxygen for use in propellant systems of the longer range missiles required a major developmental effort. The fact that liquid oxygen vaporizes at 297 degrees below zero Fahrenheit is indicative of the difficulties inherent in its field employment.

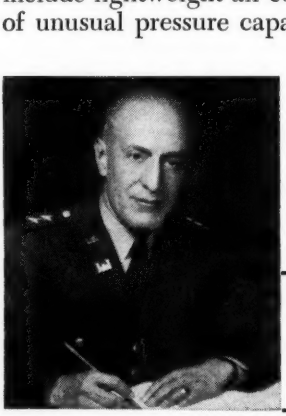
The rising power demands of electronic and other equipment associated with surface-to-air missiles has required continuing Engineer efforts to develop a family of lightweight, precision controlled gas turbines and generating equipment. Other items in this category include lightweight air compressors of unusual pressure capacities, dry ice producing equipment, and specialized fire-fighting equipment.

One of the critical problems in the use of guided missiles concerns the location of targets and the guiding of missiles to those targets. This task is a complicated one requiring close coordination of the efforts of many men. Basically it is a mapping job.

The Corps of Engineers is responsible for correlating various geodetic data and providing earth measuring information necessary to locate targets for army missiles and longer range strategic missiles. In this field, the Corps is working on methods of contouring aerial photography automatically to speed the compilation of maps, and on the use of helicopters and geodimeters — electronic distance measuring instruments—to accelerate field surveys. By means of electronic digital computers, the time required for geodetic control adjustment has been reduced by years.

To help perfect methods of rapidly and accurately locating targets within the tactical area—a zone which might be 200 miles deep on an atomic age battlefield —the Corps of Engineers is evaluating some proposed target location systems.

Recent tests involved the use of day and night aerial photography, radarscope photography to map the ground through clouds and darkness, and an electronic system



MAJOR GENERAL E. C. ITSCHNER is Chief of Engineers, Department of the Army.

to locate the photographing aircraft with respect to known ground stations. Although these tests are not expected to solve target location problems entirely, they point the way to the formulation of an interim target location system.

THIS by no means exhausts the list of Engineer responsibilties in the missile field. The Corps must build laboratories and testing facilities, often of a highly unusual nature; manufacturing plants, missile stations, training facilities, administrative facilities, launcher sites and many other types of structures. The task of acquiring real estate for these facilities is in itself a large and sensitive one.

In addition, the Corps trains men for assignment to Nike batteries and Redstone guided missile battalions; installations men, repairmen, liquid oxygen men, decontamination squads, camouflage and fire-fighting crews, and many other kinds of specialists.

In addition to its supporting activities in the weapons delivery field, the Corps has direct responsibility for establishing requirements and developing concepts and techniques of employment for prepositioned atomic weapons. The fixing and placing of atomic demolitions will be an important function of the combat engineer on the 1962 battlefield.

MOBILITY

IN ITS ultimate conception, tactical mobility is based on the availability of combat vehicles with 100 percent cross-country mobility, with sustained combat capabilities, and fully air-transportable into and within the battle zone. It implies, as well, almost complete reliance on logistical support within the battle zone by aerial transport operating from unprepared strips.

Practical considerations indicate that 100 percent cross-country mobility against all obstacles created by terrain and an ingenious enemy has yet to be attained. Even by 1962, Army operational aircraft with an effective cargo capacity will require substantial strip preparations for sustained operations. It is an inescapable conclusion that, for at least the time period under consideration, the Corps of Engineers must sustain much of the load in achieving an acceptable level of tactical mobility. Several approaches are being followed.

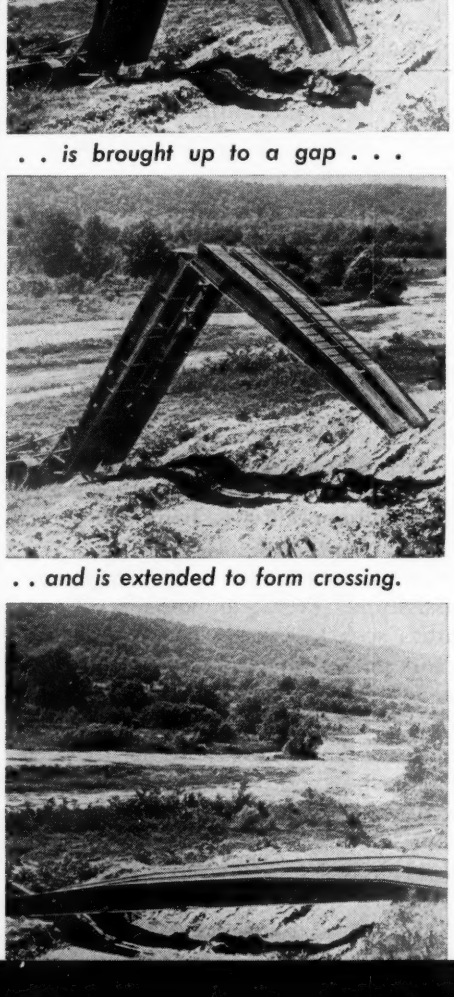
A MAJOR contribution towards improving the cross-country mobility of the Army will come from Engineer Intelligence. Information furnished by the Engineer on the terrain and its effect on cross-country movement will enable the commander to plan for and make maximum effective use of the inherent mobility of his unit. Continuing efforts are being made to improve Engineer capabilities in this field.

Research in the basic problems of ground mobility is being conducted at the Waterways Experiment Station in Vicksburg, Mississippi. Here a variety of studies seek to isolate the primary factors influencing soil trafficability and to examine the over-all influence of terrain on military operations. The problems of traversing snow and ice are an important part of the program of the Snow, Ice and Permafrost Research Establishment in Wilmette, Illinois.

ushed by tank, scissors type bridge

. . is brought up to a gap . . .

. . and is extended to form crossing.



Developments in the field of bridging have been sharply reoriented towards the battlefield of the future. Mobile assault bridging for rapid crossing of short gaps has been developed and the mobile assault ferry, now under development, will facilitate dispersed, multiple crossings of wider gaps.

Substantial progress has been made in the development of equipment and techniques for rapid clearance of enemy-created obstacles. Research is continuing in the location and identification of enemy mine fields by means of aerial reconnaissance.

In the field of tactical air transport, the reduction in runway requirements has to a degree balanced the more widespread usage envisioned. There is a continuing requirement, however, for improved Engineer techniques, materials, and equipment for hasty strip preparation.

Finally it seems probable, for the next decade at least, that the availability of roads will continue to be a critical factor in providing logistical support to and within the combat zone. The vehicle that will go anywhere will still go much faster and with less maintenance on a prepared roadbed. There seems little doubt that even in the dispersed combat zone of 1962, it will continue to be more efficient to maintain and even build roads than to depend solely on logistic support by air or cross-country.

STRATEGIC mobility, like tactical mobility, involves considerations far beyond the technical capabilities of the transport vehicle. The keynote and measure of strategic mobility is quick reaction time. This ability is affected not only by

the system of transportation employed and by the readiness of forces involved; it depends as well on our capability to mount these forces and to deploy and support them in the objective area.

The overseas base construction program being carried out by the Corps of Engineers for the Army and Air Force will greatly increase our capabilities for strategic mobility. Pre-positioning of forces and equipment at advanced bases near critical areas is perhaps the surest way to reduce reaction time. The world-wide distribution of strategic logistic airfields is also an important factor.

The maintenance of a wartime capability to support both strategic air and sea lift is a matter of continuing concern, however. In the case of airlift, two basic considerations are particularly important: first, the vulnerability of existing bases to destruction or denial as a result of atomic attack; second, the possible extension of Army requirements for air lift into areas which cannot be supported by the peacetime air base structure.

Maintaining a construction capability for air base development is facilitated to some degree by the fact that terminal requirements for future aircraft are not increasing at a rate proportional to their payloads. The potentialities of water-based transport aircraft offer promise, as well, of a substantial decrease in terminal requirements.

To a large degree, however, the capability of the Corps of Engineers to provide airfields for transport aircraft serving the Army in a future war may depend upon the ability of our air and missile defenses to keep the atomic destruction of our air bases down to nominal levels.

In the case of sea lift, the establishment of an Engineer Amphibious Support Command is expected to make an important contribution to the strategic mobility of the Army. It will provide organic means to the Army not only for amphibious assault but for maintaining continuous logistic support in over-the-beach operations so essential in the future. (See "Amphibious Support of Combat Operations," October 1957 DIGEST.)

PASSIVE DEFENSE MEASURES

THE cornerstone of passive defense is dispersion—a companion concept of mobility. It is an essential feature of the battlefield of the future, but it has severe Engineer implications. In the division zone, increased effort will be expended in clearing fields of fire (in several directions), pioneering vehicular routes, and preparing alternate positions. In corps and army zones, wide dispersion will mean maintenance of double or triple the former mileages of road network.

In terms of Engineer effort, however, the greatest change will be in the Communications Zone. Here is to be found the least dispersed of all military installations, the conventional army base.

Base development, the major Engineer construction task in a theater of operations, is entering a new era involving the use of multiple ports and rapid over-the-beach operations. Large single-class depots would be eliminated, to be supplanted by small, widely dispersed balanced-stock depots. All of these measures tend to increase the com-

plexity of construction planning and the expenditure of Engineer effort.

EQUALLY important to the security of our forces against atomic attack is the requirement for physical protection. Hazards of radiation and blast create new problems in the design of fighting positions and shelters for those combat elements who cannot always move away, and whose efforts toward deception and camouflage will not always be successful. In rear areas, our depots, ports, beaches, repair facilities, and airfields will all be in range of enemy missiles and may be located by enemy agents even if other measures fail him. These elements are subject to nuclear attack and therefore must be given some protection.

Already much technical information on nuclear weapons effects has been accumulated and good progress is being made in development of simple but adequate shelters.

Infrared equipment now under development will also improve the security of our forces against detection and atomic attack by providing an increased capability for night combat and support operations. Similar efforts are being carried forward to improve our capabilities for camouflage and deception not only against visual observation but against radar and infrared as well.

Even more important than the development of equipment, procedures and techniques for passive defense, however, is the need for thorough indoctrination and training of troops in their use. This is a command responsibility which cannot be neglected on the atomic battlefield.

MINIMUM LOGISTICS SYSTEM

REDUCTION of the logistics tail of the combat forces is a long-standing requirement to which the nature of future war can only add emphasis. Engineer efforts to support this objective have many facets.

One area of great potentiality is the Corps of Engineers program for development of heat and electrical power from prototype nuclear reactors developed by the Atomic Energy Commission. (See "Nuclear Power Program," August 1957 DIGEST.)

Since nuclear plants can operate for a long time on a small bulk of fuel, they often offer the best solution to the problem of supplying fuel at remote locations. Even today nuclear power plants are economical at very remote installations. Furthermore, they provide a dependable, self-contained power source which is less vulnerable to enemy action.

The problem of reducing the logistic burden of increased wartime construction offers a challenge which the Corps is meeting in a variety of ways. Our peacetime overseas construction program, for example, will go a long way toward meeting many of our wartime requirements. It has, as well, significant bonus benefits. It is developing capabilities and know-how among indigenous populations in many countries of the world. It is providing a wealth of experience to our military and civilian engineers in the many complex problems peculiar to these areas.

Our preparations for wartime construction also are directed towards reducing the logistic burden through maximum austerity, in-

creased use of indigenous personnel and materials, and the streamlining of construction units.

In the area of supply and maintenance, significant strides have been made in rendering rapid and flexible support. The use of Automatic Data Processing Systems, including electronic computers, will substantially reduce inventory requirements through almost instantaneous processing of requests and constant review of supply levels. Significant progress is also being made in procurement standardization. Under this program the number of makes and models of Engineer equipment will eventually be reduced at least 70 percent, with consequent diminution in supply and maintenance problems.

These are only some of the areas in which significant progress has been made in creating a capability for rendering adequate support at minimum cost in manpower and materials. Integrated into the broader programs of the over-all Army logistical system, they offer great promise of developing a minimum Engineer logistics system for the future.

THE Army today is on the threshold of a new and largely unexplored era in military affairs—an era in which success on the battlefield of the future may depend as never before on our ability to adjust concepts, doctrine, tactics and organization to meet the challenges imposed by it. The Corps of Engineers has a vital role and a fourfold responsibility in meeting this challenge—namely,

- supporting the development and effective employment of advanced weapons delivery systems.
- providing means and resources by which the Army can attain tactical and strategic mobility,
- developing techniques and procedures for passive defense measures so essential to the security of forces on the atomic battlefield, and
- contributing to the defeat of an enemy at a minimum cost in critical manpower and materials.

THESE responsibilities are being carried forward with realism, courage, and optimism in the firm conviction that any war of the future, as in the past, will find the Army capable of securing final victory by seizing and dominating the source of the aggressor's combat power—his people and his land.

THE U. S. ARMY—A KEY TO PEACE

1962

WHY should a belligerent nation
consider waging toxicological warfare
when thermonuclear weapons can cause
such vast destruction?
A probable answer is that military attacks
are not necessarily undertaken to destroy.
The objective may be to occupy
and use the area under attack.
A completely devastated region
is a loss to the country of which it is a part,
but it adds little if anything to the strength of the conqueror.
It may even become a burden to him.

CBR Attack

TO achieve the most useful results
the attacker could use
chemical-biological-radiological weapons
which do not destroy facilities.
They attack people who operate the facilities,
and the degree of their damage to people can be controlled.
These weapons also can be devised
to attack animals and plant life
leaving factories, mines, railroads, hospitals, housing intact.

THE kind of agent which might be used
in this warfare would depend on what the enemy
hoped to get out of his attack.
If he wanted to kill large numbers of people,
he would have a number of diseases from which he could choose.
But he might want only to make people sick.
For this purpose he again
would have a choice of diseases.

Major General William M. Creasy

cky Invisible Invader

THE ARMY of 1962 will be the product of accelerated evolution; it will not suddenly emerge in being overnight; it is at least partially in being today.

Today, or in 1962, such an Army presents enormous new challenges to an enemy—even one with a vast reservoir of nuclear destructive power in his arsenal.

Consider the problem for a moment from a potential enemy's point of view. He finds himself confronted with an extremely formidable foe—a foe with good leadership, training, morale; with weapons certainly equal to his own, with vastly increased firepower—a foe hard to hit and pin down.

Thus confronted with tremendously reduced possibilities of a quick knockout in a head-on clash of forces, what alternatives remain for a determined potential enemy bent on conquest of United States forces in the field?

One of the alternatives could very well be chemical, biological or radiological (CBR) warfare.

WHY should a potential enemy consider CBR warfare when thermonuclear weapons can achieve such vast destructive power?

The answer is not complicated.

Military attacks are not necessarily undertaken to destroy, but to occupy territory for which the occupier foresees a use.

World War II was the most costly and destructive conflict in history. More than 52 million people were killed or injured—more than half of them civilians. The belligerent nations spent more than a trillion dollars on armaments and war materials. The other material costs were immeasurable. And the world

has seen how costly it has been to rebuild destroyed nations.

From this object lesson, we can see why CBR weapons may well appeal to an aggressor. The use of nuclear weapons on an indiscriminate basis would undoubtedly destroy facilities which were the object of an enemy's aggression, or at least render them worthless for postwar use. To make his aggression worthwhile, these highly coveted productive facilities would have to be reasonably intact at the end of hostilities.

To achieve this result, the enemy could use CBR munitions which would attack only people. By causing death or merely debilitating illnesses among industrial workers, their productive capacity would be lost or severely limited. And with this decrease in production, the Free World's armed forces would soon become seriously weakened through the lack of munitions, equipment, food, medical supplies.

In addition, it is quite conceivable that an enemy would consider the need for captive labor to man the factories he has captured intact. Nuclear munitions would kill or maim great numbers of people, rendering them of little use in the postwar economy.

But through the use of specific chemical, biological or radiological agents, the enemy might seek to make industrial personnel so ill that they could not work for long intervals of time during the period of combat—but leave them available as a manpower supply later on.

MINIMUM DESTRUCTION AGENTS

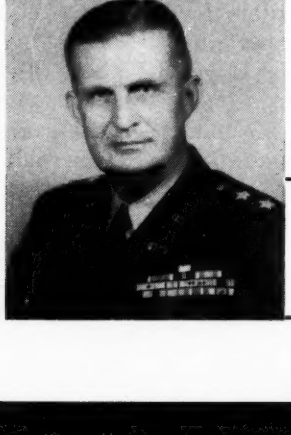
THIS is a most significant feature of CBR weapons. They are agents of minimum destruction—*i.e.*, in themselves they do not cause destruction of facilities, but instead attack the people who operate the facilities. Further, the degree of their effect upon people can be controlled. The advantages of this important fact to the plans of an aggressor can readily be seen.

But there is still another consideration which might be equally, if perhaps not more, tempting. This would be the fact that through the use of CBR warfare, an enemy's own losses might be considerably reduced.

The United States, it will be recalled, did not use this type of warfare in World War II. At the outset of that conflict, we announced that chemical warfare would be used only in retaliation for similar attacks upon ourselves.

But would a future aggressor give us this advantage?

It would appear highly unlikely. Indeed, our potential enemies have already openly announced that their planning for the next war includes the possible use of CBR weapons.



MAJOR GENERAL WILLIAM M. CREASY is Chief Chemical Officer, Department of the Army.

THERE is still another military advantage-factor in the use of such weapons which might appeal to an aggressor nation—namely, their effectiveness. U.S. casualties in World War I showed that a man wounded by gas had a 14 times better chance of survival than did a man hit by flying lead or steel. An aggressor might well consider that this causes a drain upon manpower reserves since a non-fatal casualty needs five or six other people to care for him during the convalescent period, while a dead person is no such liability. The same reserve-depleting effect could be achieved whether chemical, biological, or radiological agents were employed.

One final—and vastly important—advantage-factor in the use of CBR warfare which might appeal to an aggressor nation or bloc is the fact that the utilization of various agents in this field permits the covering of large areas to military advantage with a minimum of logistical effort. This means greatly reduced expenditures of material and industrial resources.

SPECIFICALLY, what are some of these CBR agents which might be employed by an enemy—today or in 1962? A look at the chemical weapons now available will make clear the potential in this field five years hence.

Those who know nothing about the war gases, or have only a smattering of misinformation about them, think of them as strangling, pain-producing horrors.

But actually, among the most painful of the war gases are those which are used for harassing effect and which do not cause actual battle casualties. An example would be tear gas, which is employed for riot control. Its effects—crying, coughing, skin prickles—are quite irritating for a while, but pass off within an hour or so.

OF THE real casualty-producing agents, the three principal types are the vesicants or skin-burning agents, the lung irritants, and systemic poisons. Mustard gas is a vesicant, while phosgene is an example of a lung irritant.

Newest of the systemic poisons are the nerve gases. They are colorless, odorless, and much more lethal than any other war gas yet perfected. They were discovered by the Germans during World War II, in the course of research designed to develop improved insecticides. The *Wehrmacht* had quantities of nerve gas stored and ready for use during that war.

Indeed, considering the advances already made, science fiction descriptions of nerve gases, paralyzing gases, and gases that affect the minds of men, could well be closer to the realm of fact than fiction in the course of the next five years.

These, then, are some of the threats to be considered in the field of chemical warfare. Similar hazards exist in the areas of biological and radiological attack.

BIOLOGICAL agents may be used to produce death, disease or debility among men, animals, or growing plants. Such agents are classified into three groups: living organisms; toxins, which are toxic substances derived from living organisms; and crop agents, including chemicals which might be used as crop poisons.

Protective devices under development include this suit of air-tight butyl rubber.

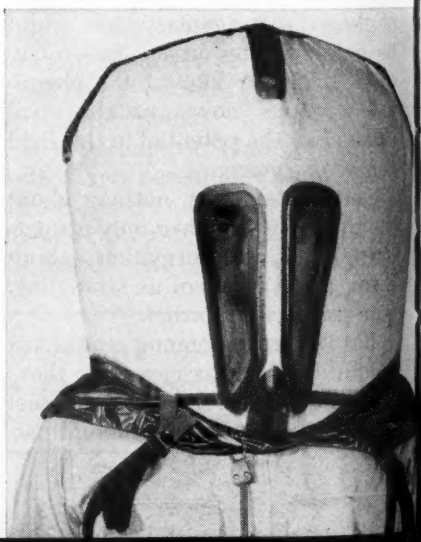
Among the harmful types of living organisms are many of the form commonly called bacteria and viruses. Many different types and forms of these micro-organisms might be used against man, animals, or plants.

Toxins are powerful poisons produced by the life processes of various living organisms. Some micro-organisms, like diphtheria, produce toxins within the body of the victim or "host." The poisons may also be generated in some other environment and later taken into the body, as in the case of food poisoning.

Crop agents are either micro-organisms which attack vegetation, or chemicals which retard the growth of a plant or destroy its life. Although such use of chemicals might rather be classified as a part of chemical warfare, the nature of the action and its uses has placed it in the biological warfare field.

The kind of agent which might be used in biological warfare would depend on what the enemy hoped to get out of an attack. If he wanted to kill large numbers of people, he would have a number of pathogens from which he could choose. But an attacker might only want to make people sick, rather than kill them. For this purpose, other agents might be used.

Biological warfare agents also could be used to attack the animals upon which man depends for food



Mask of porous material that filters out CBR agents is designed for persons with head wounds.

"Automatic alarms will give a signal when they detect minute quantities of gas in the air."

and clothing; and many kinds of plant disease-producing agents could be used to attack his food crops. Disease could damage grains, fruits, green vegetables.

The very nature of biological warfare gives an aggressor nation great flexibility in methods of delivery. Effective employment is possible by means ranging from use by saboteurs against selected installations to mass delivery over large areas by airplanes, submarines and missiles.

Third, and by no means the least, of the CBR threats is that of radiological attack.

RADIOLOGICAL warfare is the attack on personnel by means of radioactive agents. This may be the result of fallout caused by the burst of a nuclear weapon, or it may result from distribution of radioactive material by other means, such as by small bombs dropped from planes or missiles. With the latter system there would be little or no attendant destruction of facilities.

With this type of warfare, an enemy could cause short- or long-term contamination and denial of large areas, depending on the means of contamination and the material employed. And a similar control could be exercised in regard to troops and population in those areas—whether to kill or merely incapacitate.

Another type mask, light-weight, pocket-sized, with no bulky canister, protects against vapors and dust.

METHODS OF DEFENSE

IT IS TRUE, of course, that advances have been and are being made in methods and techniques of defense against attack by chemical, biological, radiological means.

Let us consider for a moment these advances as they might apply in 1962 if an attack were made against a large industrial city.

Our assumptions also include the fact that, because of its strategic value, the city is under long-range attack by the enemy in order to cut down on its war material production. The enemy, however, recognizes a foreseeable need for the plants and factories in the post-war period and so is attempting to neutralize the production effort by using non-destructive weapons in the CBR field, whenever and wherever it is practicable to do so.

We must assume that this hypothetical city has a good civil defense system in which the populace takes an active part; that adequate protective equipment for defense against CBR weapons has been developed, procured, and distributed; and that full use is made of that equipment. Much of that equipment will have been developed by the U.S. Army Chemical Corps and adapted to civil defense use.

THE FIRST problem of residents of this city of 1962 will be to know whether the enemy has staged a chemical or biological attack. This is not simple, since CBR, or toxicological, agents are not easily detected by the human senses.

For chemical attack, the threatened city will have automatic alarms which will give a visible or audible signal when the mechanism detects minute quantities of agent in the air.

To identify the type of agent being used, the city will have identification sets which can be simply operated by personnel with a minimum of special training.

For detection of biological attack the city will have devices which can count microscopic, airborne moisture particles, germs, or dust, with amazing speed. By indicating the presence of unduly large amounts of foreign matter in the air, they can alert the city that an attack may be under way. Rapid means of identifying germs will be available.

In the radiological field, the attacked city will employ a new type of dosimeter which detects and measures the amount of radiation to which a person may have been exposed.

Those are some of the means which residents of the target city would use to detect and warn them that they have been subjected to an enemy chemical, biological, or radiological attack.

However, detection and identification would be of little use without means of protection.

COMMUNITY PROTECTION

PROTECTION of a community falls into three categories: individual, family, collective protection.

The primary means of individual protection is the protective mask. This inexpensive, lightweight, pocket-size item has been developed to the point where it not only protects against chemical vapors, but also protects a person from breathing in bacteria or radiological dust.

Such a mask will protect a person from breathing contaminated

air, but since some agents attack the body through the skin, the city must also have a supply of impermeable clothing for protection of those who must perform missions within contaminated areas.

FOR family protection, an important aid will be "diffusion board," a gas-aerosol filter material resembling ordinary wallboard but so made that air can pass through it quite freely. This fiberboard has excellent gas-arresting properties. In small shelters, it operates almost as efficiently and effectively as a forced-flow type of filter. It also filters out biological agents and atomic or radioactive dust. In the target city, family-type bomb shelters would be lined with it.

THE CITY'S public bomb shelter program includes use of large mechanical collective protectors in shelters that have been, or can be made, reasonably air-tight. Their basic operating principle is the same as that of a protective mask, except that the air is forced through the filters by motor.

The city also is presumed to have an adequate supply of infant protectors—rectangular boxes consisting, in part, of the gas-aerosol filter material, semi-clear plastic for vision, and a rigid bottom to support the child.

For nerve gas victims, the city is prepared with atropine syrettes, and its rescue workers are trained in the back-pressure arm-lift method of artificial respiration. If atropine can be injected into the victim within 30 seconds after the first symptoms appear, it will help counteract the action of the gas. These syrettes are a part of the standard military equipment, as is the protective mask. The new method of artificial respiration has been made standard, too, because it induces more fresh air into the lungs and is more efficient than the old method.

Besides the physical means of protection against biological warfare agents, the city also has the benefit of numerous important advances in the bio-medical field, including disease-preventing vaccines, and a means of giving multi-immunizations with one injection, to replace the old method of giving numerous shots for various diseases.

BY EMPLOYING these and other methods, the city could effect a great reduction in casualties from toxicological attack. These actions must, of course, be taken with full cognizance of the fact that the enemy may choose to use nuclear weapons alone or in conjunction with toxicological attacks. Thus the means of defense employed against these agents, as described here, must be in addition to such measures as digging in for protection against blast, thermal and radiation effects of nuclear weapons.

1962

Army Ordnance Looks to the Future

Lieutenant General E. L. Cummings

FIVE years ago announcement was made
of the first atomic firepower available to the Army—
the 280mm atomic cannon.
That cannon has now been joined
by Honest John and Corporal.
In the Army of 1962 an atomic capability will exist
for most Army missiles.

EVERY Army missile is tested and proven.
In a typical test-flight of a Redstone guided missile,
141 separate channels of essential information
are telemetered to the launching station
from the missile in flight.
At White Sands Proving Ground in 1956,
about 200 missiles of varied kinds were fired every month.
Each firing is fully instrumented
to gain maximum improvement at greatest possible savings
in time and money.

ALL Army missile systems are designed
to be transportable by plane,
as well as by road, rail, or ship;
and some will be transportable by helicopter.

THE Army has just begun to reap the harvest
of pioneering work in guided missiles and rockets.
Army Ordnance has thousands of seasoned and successful
guided missile scientists, engineers, and technicians.
Throughout its arsenal system there are
many other thousands of scientists, engineers, and technicians
with closely related skills and experience.

IN 1962, when Army Ordnance will have completed a century and a half of service to the Army and to the Nation, its mission will remain as always—to supply the world's finest Army with the world's best weapons and ordnance.

Basic to the accomplishment of this mission—both for today and 1962—are three principal premises:

- The most important single development in our means available to deter or defeat aggression is the military application of atomic energy.
- The means of delivering atomic or other firepower on target are improving with marvelous rapidity through the development of rockets, missiles and other systems.
- The soundest national defense can be built only upon our ready capability to deliver a measured application of force appropriate to a variety of military situations and requirements. This measured application of force may be obtained not by "wonder" weapons alone nor by "traditional" weapons alone, but only by a judicious combination of both.

It is in this realm of "either/or" capability that Army Ordnance is expanding in current application and helping to build for the Army of 1962 and beyond.

PROBABLY the best single indicator of the gains that may be confidently expected in the next five years is the accelerated progress that has already been achieved over the past five years. Consider some examples:

In October 1952, little more than five years ago, announcement was

made of the first atomic firepower available to the Army—the 280mm atomic cannon.

Today Corporal and Honest John broaden our operational atomic capability. In the Army of 1962, an atomic capability will exist for most Army missiles.

In 1952 there were no Army missiles operational. Today, three are operational — Nike-Ajax, Honest John and Corporal.

In the Army of 1962 these will be supplemented by Redstone, Little John, Sergeant, Lacrosse, Dart, Nike-Hercules and Hawk — plus others still classified and under development.

In the field of traditional weapons and equipment, advances already made by Army Ordnance, taken together with our atomic and missile progress, add up to notable gains in giving the 1962 Army the necessary "either/or" posture.

Consider in detail, for example, the long strides forward that have been taken in each of these three fields—atomic, missile, traditional.

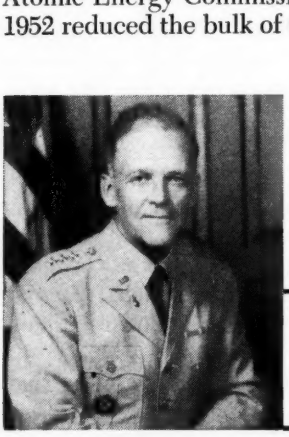
ATOMIC FIREPOWER

IN atomic firepower, the joint efforts of Army Ordnance and the Atomic Energy Commission had by 1952 reduced the bulk of the atomic bomb to fit the first atomic cannon. Today scores of Ordnance scientists, engineers and technicians continue their development work on adapting the various sizes and yields of AEC-developed nuclear warheads to the missiles and artillery of 1962. Early in 1957 the Army announced an 8-inch atomic shell.

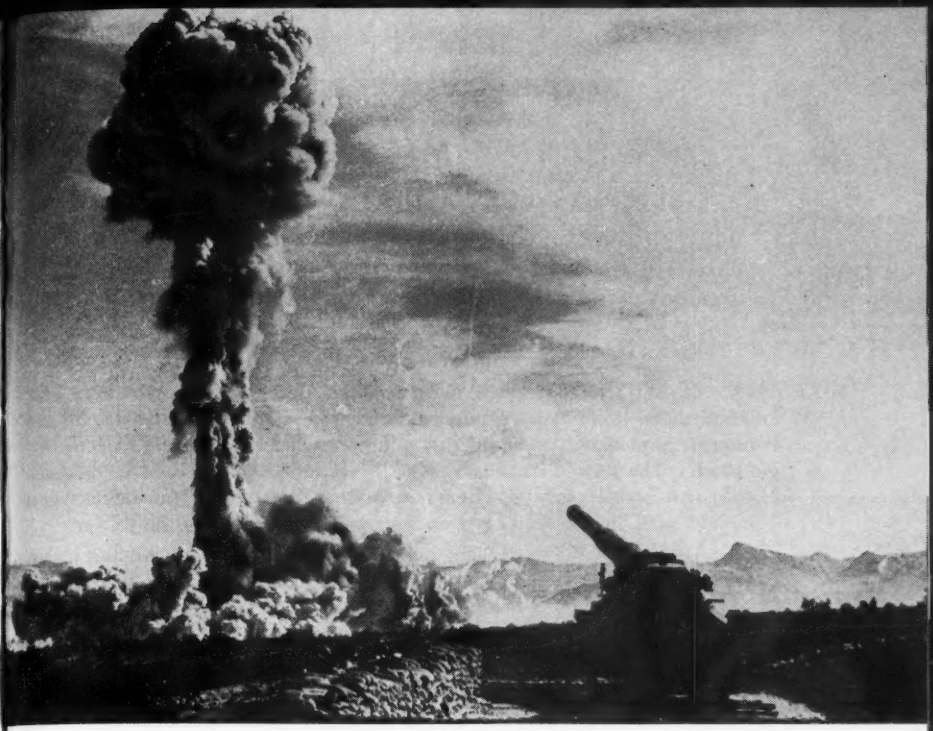
Reflect for a moment on two striking examples of the significance of atomic firepower to the Army of 1962.

Just one round of atomic field artillery, or just one field artillery missile with atomic warhead, will provide the 1962 field commander with organic firepower equivalent to the massed fire of thousands of field artillery battalions using high explosive rounds. And just one antiaircraft missile with an atomic warhead will have the capability of destroying a whole formation of aircraft. The effects of such devastating firepower on the strategy and tactics of 1962 are enough to challenge the imagination of every field commander.

Logistics are similarly affected. For example, one missile transporter-launcher truck in 1962 will transport firepower equivalent to a trainload of high explosive rounds. On the other hand, the threat or use of atomic weapons in enemy hands will force a dispersal, flexibility, and mobility of maintenance and supply that will demand our best efforts to accomplish.



LIEUTENANT GENERAL E. L. CUMMINGS is Chief of Ordnance, Department of the Army.



A mushroom cloud billows up from history's first atomic artillery shell, fired from the Army's 280mm gun.

One final illustration of the importance of the 1962 Ordnance role in the military application of atomic energy is that the hazardous yet indispensable task of Explosive Ordnance Disposal—whether conventional or atomic, friendly or enemy—will still continue as an Ordnance responsibility.

We pledge to the Army of 1962 the finest atomic firepower in the world.

ROCKETS AND MISSILES

TURNING now to the field of Army rockets and guided missiles, the 1962 Army will be armed with a broad array of missiles to meet every tactical requirement, regardless of weather or visibility. These range from the 3.5-inch diameter anti-tank rocket, about two feet long, to the impressive dimensions of the Redstone missile. *(See p. 58.)*

FOLLOWING are five subpoints concerning missiles for the Army of 1962 that should be emphasized:

1. Army Ordnance is completely responsive to the missile needs of the field forces—battle group, division, corps, army or army group. It is successfully meeting, or has already met, every requirement made of it. Solid or liquid fuel, single-stage or multiple stage types are utilized as desirable and feasible. And there is no missile in which improvements are not being made.

2. Army Ordnance develops complete missile *systems*. This means that it hands the field forces a missile "package" including all related equipment, materials and services, requiring only the fighting men themselves to make up a self-sufficient combat unit. Then it backs

ARMY MISSILES

THE FOLLOWING TABULATION shows the arsenal of artillery-type missiles to be operational in the Army of 1962—unless they are sooner replaced by something even newer and better.

Surface-to-Air

NIKE-AJAX. In test after test the supersonic Nike-Ajax—already operational—has knocked down every type of target offered it. Set in motion by a solid fuel booster, it is powered by liquid fuel and controlled by a system of command guidance. The missile itself is about 20 feet long and one foot in diameter. Missile and booster together weigh more than one ton. The entire system is mobile, suitable for field or fixed use.

NIKE-HERCULES. Capable of carrying an atomic warhead, this missile flies higher, faster and farther than Nike-Ajax. The missile is about 27 feet long, booster 14.5 feet long; and both will use solid propellant. Nike-Hercules will be operational in near future.

HAWK. About 16 feet long and 14 inches in diameter, this "bullet with a brain" will be used for defense against low-flying aircraft. It has a lethal, modern warhead and extremely successful guidance techniques. Already in the "hardware" stage, it is now successfully undergoing test. It uses a solid-fuel propellant.

Surface-to-Surface

DART. This highly mobile guided antitank missile offers a high probability of first-round hit with a warhead which can defeat any known armor. Already in the hardware stage, it is now undergoing test.

LITTLE JOHN. This supersonic free-flight rocket—about 12 feet long, 1 foot in diameter, and powered by solid propellant—has a range of medium artillery. It can be transported by helicopter. Hardware now successfully undergoing test.

LACROSSE. This supersonic close-support guided missile—about 19 feet long, 20 inches in diameter, and powered by solid propellant—is highly mobile, fired from a launcher mounted on a standard truck. Now in production.

HONEST JOHN. This supersonic free-flight rocket—about 27 feet long, 30 inches in diameter and powered by solid propellant—can carry an atomic or high explosive warhead to a range equivalent to long-range artillery. Highly mobile on its truck transporter-launcher, it is operational in CONUS and overseas.

SERGEANT. Details classified.

CORPORAL. This supersonic guided missile—about 45 feet high and powered by liquid propellant—can carry an atomic or HE warhead to a range of about 75 miles. Operational in CONUS and overseas.

REDSTONE. This supersonic guided missile—69 feet high, 70 inches in diameter and powered by liquid propellant—can carry an atomic or HE warhead to a range of about 200 miles. The 40th Field Artillery Missile Group, consisting of the 217th FA Battalion (Redstone), 630th Ordnance Company and 580th Engineer Company was activated at Redstone Arsenal in September 1957. It will be assigned to the Third Army as a part of the Strategic Army Force.

up the missile system with complete Ordnance service in the field.

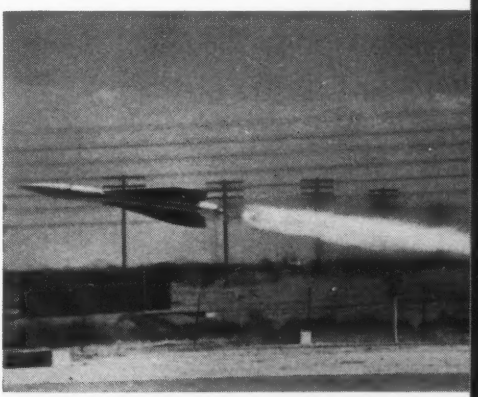
3. Army Ordnance develops missile systems for maximum flexibility and mobility. As an illustration, all Army missile systems are being designed to be transportable by plane, as well as by road, rail or ship. Applications of certain missiles are also being developed for helicopter transportability.

4. Army Ordnance builds maximum effectiveness, ease of handling and dependability into every missile. Each is built to work right, to be safe, rugged, and as simple and fast as possible to handle, maintain and launch, in the face of the ever-increasing complexity of missile systems. Every missile is tested and proven. In a typical test-flight of a Redstone guided missile, 141 separate channels of essential information are telemetered to the launching station from the missile in flight. At White Sands Proving Ground in 1956, about 200 missiles of various types were test-fired every month, about 2400 during the year. Each firing is fully instrumented to obtain optimum missile improvement at the greatest saving in time and money.

5. The Army has just begun to reap the harvest of pioneering work in guided missiles and rockets. At the Army Ballistic Missile Agency, Redstone Arsenal, White Sands Proving Ground, Diamond Ordnance Fuze Laboratories and Jet Propulsion Laboratories, Army Ordnance has thousands of seasoned and successful guided missile scientists, engineers and technicians. Throughout its arsenal system, there are many other thousands of scientists, engineers and

The Lacrosse, highly mobile supersonic close-support guided missile (above), is now in production.

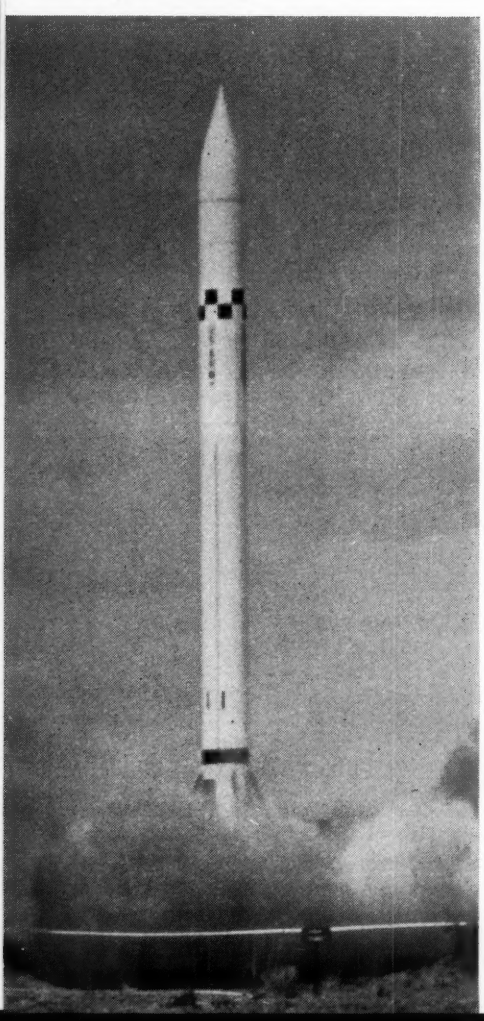
The Dart, highly mobile, offers probability of first-round hit with warhead designed to defeat any known armor.



The Hawk is the Army's newest surface-to-air guided missile for defense against low-altitude aircraft.

Honest John can carry an atomic or high-explosive warhead to range equivalent to heavy artillery.

The Corporal, a supersonic guided missile now operational, extends artillery range to 75 miles.



technicians with closely related skills and experience.

These critical skills and priceless capabilities are rapidly being geared into our guided missile effort. Together this task force represents one of the greatest bodies of experience and creative genius in guided missile programs anywhere in the world. The best in missiles is yet to come.

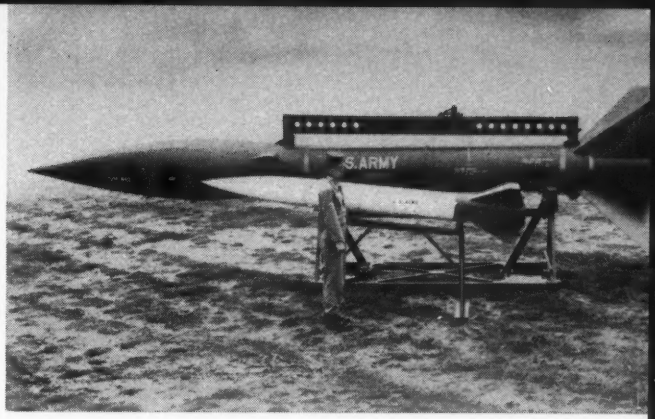
We pledge to the Army of 1962 the finest missiles and rockets in the world.

TRADITIONAL WEAPONS

IN describing advances and developments in the field of traditional weapons and equipment for the Army of 1962, the term "traditional" is preferred rather than "conventional" because the dictionary meaning of the latter—*i.e.*, "ordinary" or "trite"—is a poor description of this segment of our weapons system, especially in the light of the dramatic progress being made in arming and equipping the new Pentomic Infantry and Airborne Divisions, and the new Armored Division.

Take one specific mission, for example—the defeat of enemy armor:

Each type of division will have a variety of means to destroy armor. In addition to the atomic firepower



Little John is a supersonic free-flight rocket that has the range of medium artillery.

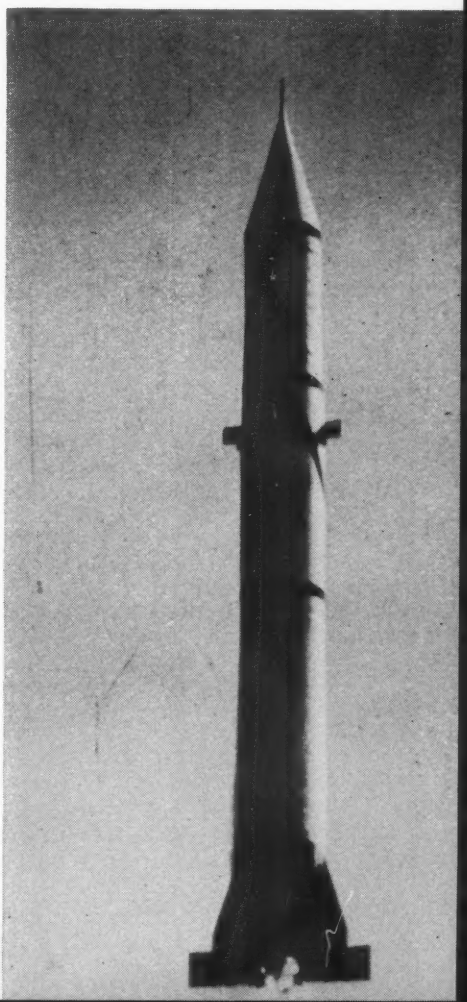
by missile or artillery and the use of the Dart missile already mentioned, the M40 106mm Battalion Anti-Tank recoilless rifle, jeep-transported and crew-served, would also do the job.

At the platoon level, a single American soldier, armed with the current 3.5 inch super bazooka, which employs the shaped charge principle for blasting through armor, has a very great capability to defeat most armored vehicles. Currently undergoing tests is a new shoulder-fired recoilless antitank rifle, which is intended to replace the super bazooka and which will increase the effective range and antitank lethality of the individual soldier's weapons to a level never before attained.

The new divisions are thus splendid examples of the "either/or" capability. Each capability supplements the other, making for a stronger whole. And each division is so structured as to be able to adopt, without basic reorganization, new developments as they become available.

ALL three types of divisions will use the new family of small arms. Our new rifle, the M14, replaces three former shoulder weapons—the M1 rifle, carbine and sub-

The Redstone supersonic guided missile extends artillery striking power to a range of about 200 miles.



Nike-Hercules, the Army's new surface-to-air guided missile, is tested at White Sands Proving Ground.

machine gun. It is lighter than the M1, is just as accurate and dependable, and offers a choice of full- or semi-automatic fire. A heavy barrel version of this weapon will also replace the Browning Automatic Rifle. (See "New Basic Infantry Weapon System," July 1957 DIGEST.)

The Army's new M60 general purpose machine gun replaces all three of the former caliber .30 infantry machine guns, equals or surpasses them in rate of fire, yet weighs only 23 pounds as compared to their 32 or 42 pounds.

All of these new weapons fire the new 7.62 millimeter NATO cartridge, lighter and smaller than the former caliber .30 round, yet possessing equal accuracy and stopping power.

The result of this new small arms family is two basic weapons replacing seven, and one round of ammunition replacing three — resulting in increased firepower, yet reduced logistical requirements and simplified training.

EACH type of 1962 division will have organic atomic capability, giving a single division greater firepower than armies or even army groups had in World War II.

But even this firepower, of itself, is ineffective until mobility brings it to bear on the objective. Each division will therefore have far greater mobility and celerity. Consider the three new type divisions in turn:

Mechanical Mule, successor to the traditional four-footed version, carries more than its own weight.

Nike-Ajax missiles stand at the ready at one of the many sites now guarding American cities.

● In the Pentomic Infantry Division, an entire battle group will be rapidly concentrated or dispersed, as needed, and in far greater safety, through M59 personnel carriers—fast, amphibious, cross-country vehicles capable of transporting an entire squad in armored protection.

● The Pentomic Airborne Division will be completely air-transportable, in contrast with the old type which was only partially so. Three significant Ordnance developments are involved: (1) the increased capability of new antitank weapons will greatly reduce the danger of effective counterattack by enemy armor, and thereby help compensate for the elimination of tanks; (2) the availability of atomic firepower permits a reduction in artillery; and (3) the reduction in weight and size of vehicles permits their complete air-transportability. The M-274 Mechanical Mule, for example, carries 120 percent of its own weight.

One additional Ordnance aspect is of particular interest: The new maintenance battalion has a plurality of Ordnance personnel, and is commanded by an Ordnance officer. Ordnance personnel in 1962 will jump into the airhead with the assault element.

● The new Armored Division gains mobility through the addition of both more tanks and more M59 personnel carriers, to transport a smaller number of personnel. Tank for tank, on an across-the-board

The M40 106mm Battalion Antitank (BAT) recoilless rifle provides great armor-destroying ability.

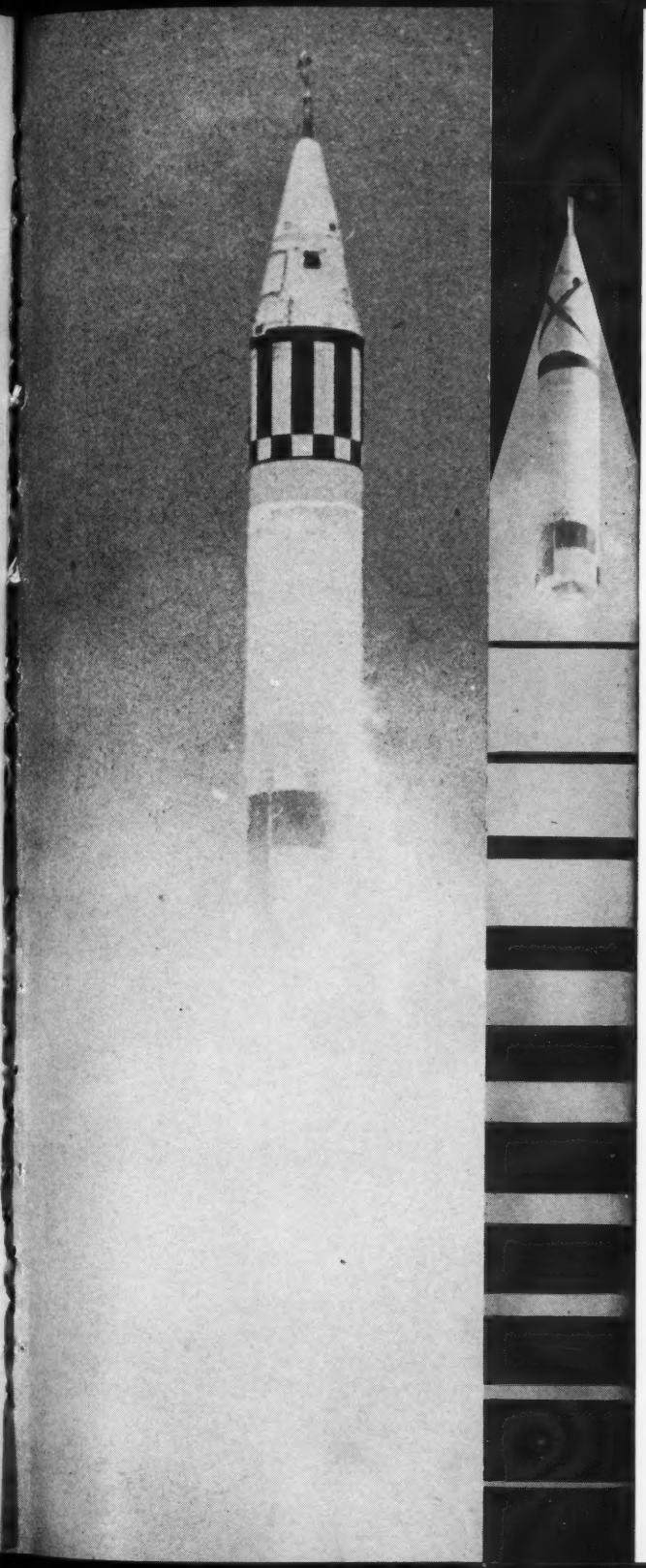
basis considering mobility, firepower and armor protection, American armor is unequalled.

A practical tank gun stabilization system to permit accurate fire while the tank races over rough terrain is only one of the possible improvements now being worked on for the Army of 1962. There are promising developments, too, in light combat vehicles, self-propelled artillery, spaced-link tracks, novel power plants and power trains, and other areas as well.

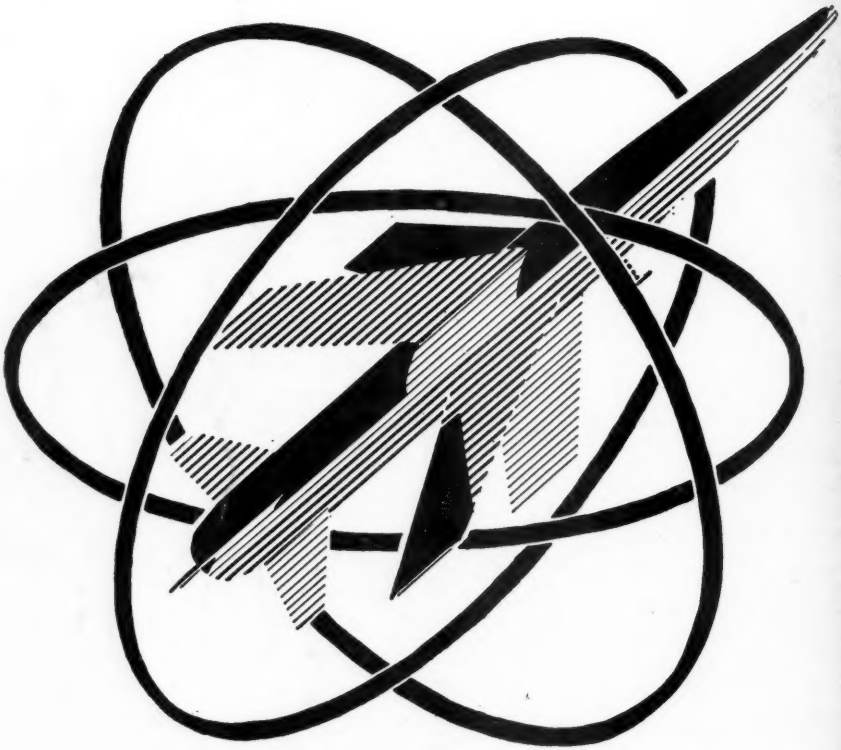
THUS in traditional weapons and equipment, just as in atomic firepower and missiles, Ordnance is moving rapidly ahead to serve the Army of 1962.

We in Ordnance are acutely conscious of our responsibility to provide the major part of the Army's firepower and mobility—the well-rounded capability to fight and win any war that may be forced upon us, big or little, nuclear or conventional, or any combination. Keenly aware of the crucial importance of this task, *we pledge to the Army of 1962 the finest all-around Ordnance materiel in the world.*

Looking ahead, it is certain that the year 1962 will find the Ordnance Corps hard at work on its mission of providing unsurpassed firepower and mobility for the Army of 1972 and 1982—and even farther in the future.



U.S. Army Jupiter Intermediate Range Ballistic Missiles soar skyward from the launching pad at Cape Canaveral Missile Test Center, Florida.



THE U. S. ARMY—A KEY TO PEACE